Onshore Titanium and Related Heavy-Mineral Investigations in the Eastern Gulf of Alaska Region, Southern Alaska

By Jeffrey Y. Foley, René D. LaBerge, Andrew E. Grosz, Frank S. Oliver,

and William C. Hirt

UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. BUREAU OF MINES

Open File Report 10-95

CONTENTS

ILLUSTRATIONS

Page

TABLES

UNIT OF MEASURE ABBREVIATIONS

A	ampere	m^3	cubic meter
g	gram	pct	percent
g/t	gram per metric ton	ppb	part per billion
KeV	Kelvin Volts	ppm	part per million
km	kilometer	wt.	weight
kg/t	kilogram per metric ton	wt. pct	weight percent
m	meter		

MINERAL NAME ABBREVIATIONS USED IN THIS REPORT

Amp	amphibole	Mag	magnetite
Bio	biotite	Mon	monazite
Carb	carbonate	Ol	olivine
Chr	chromite	Px	pyroxene
Epi	epidote	Qtz	quartz
Feld	feldspar	Rk frags	rock fragments
Gar	garnet	Rut	rutile
Hem	hematite	Serp	serpentine
Ilm	ilmenite	Sph	sphene
Inc	inclusion	Zir	zircon
Leu	leucoxene		

Onshore Titanium and Related Heavy-Mineral Investigations in the Eastern Gulf of Alaska Region, Southern Alaska

By Jeffrey Y. Foley[1], René D. LaBerge[2], Andrew E. Grosz[3], Frank S. Oliver[4], and William C. Hirt[5]

ABSTRACT

The U.S. Bureau of Mines has completed a study to evaluate titanium resources in heavy-mineral beach sands along the coast of the eastern Gulf of Alaska. A total of 546 samples were collected from intertidal zone, beach face, back beach, and wave-cut beach terrace deposits in the Cape Yakataga, Yakutat, and Mt. Fairweather areas. Heavy minerals were preconcentrated by a three-turn spiral into two products: rejects (tailings) and concentrates. High-intensity magnetic barrier separation of selected spiral concentrates produced mineral fractions to facilitate mineral characterization by using optical and scanning-electron microscopy.

Total identified heavy-mineral resources in the region include 450-500 million metric tons of sand in modern shoreline deposits containing 0.5 to 3 percent valuable heavy minerals with undetermined gold byproduct. Unmeasured deposits of comparable size and grade exist inland of the shoreline deposits. Unexplored resources also exist offshore of the areas investigated during this study.

Samples from Cape Yakataga contain an average of 0.57 percent valuable heavy minerals (0.49 pct ilmenite; 0.05 pct rutile; 0.03 pct zircon), with a range of less than 0.1 to 2.9 percent in 68-120 million metric tons of sand. Additional sparsely sampled deposits in the Cape Yakataga area contain 128 million metric tons. At Yakutat, the valuable heavy minerals make up an

---

[1] Geologist, U.S. Bureau of Mines Alaska Field Operations Center, Anchorage, Alaska, presently at Salt Lake City Research Center, Salt Lake City, Utah.

[2] Geologist, U.S. Bureau of Mines Albany Research Center, Albany, Oregon.

[3] Research Geologist, U.S. Geological Survey, National Center, Reston, Virginia.

[4] Physical Science Technician, U.S. Bureau of Mines Salt Lake City Research Center, Salt Lake City, Utah.

[5] Group Supervisor, U.S. Bureau of Mines Salt Lake City Research Center, Salt Lake City, Utah.

average of 3.4 percent (3.23 pct ilmenite; 0.11 pct rutile; 0.05 pct zircon) ranging from less than 1 to 14.8 percent of 57 million metric tons of beach sand. Samples from the Mt. Fairweather area contain an average of 2.4 percent valuable heavy minerals (2.43 pct ilmenite; 0.01 pct rutile) ranging from less than 1 to 14.3 percent. From the Situk River, near Yakutat, to Boussole Bay in the Mt. Fairweather area, there are 192 million metric tons in modern shoreline deposits. The dynamic environment of deposition for these sediments produces large variations in the heavy-mineral content of the sand and limits the accuracy of resource estimations.

A comparison of chemical data for spiral concentrates and spiral rejects suggests that a significant portion of the valuable heavy minerals in the beach sand samples were rejected by the spiral during heavy-mineral preconcentration. These studies therefore provide minimum grade estimates for the heavy-mineral resources of this region. The presence of inclusions in the valuable heavy minerals, the presence of sphene, and the generally high calcium and magnesium contents are all likely to interfere with conventional processing and might detract from the value of these deposits. Slag processing of iron-rich ilmenite (Fe:Ti ≈ 50:50) concentrates will likely be required prior to pigment production.

Heavy-mineral deposits in the region contain small quantities of gold that could be variably recovered by combinations of gravity and flotation procedures. Although many samples contain detectable gold (as much as 2.1 g/t), most contain less than the detection limit (0.03 g/t) and the best estimate of gold content in the bulk tonnage resources is less than 0.056 g/t Au. Because of the generally fine particle size and flat shape of the gold grains, recovery problems can be anticipated.

ACKNOWLEDGMENTS

The authors are grateful for the cooperation of land administering agencies in the study area. These include the National Park Service, U.S. Forest Service, and the Alaska Department of Natural Resources.

The residents and business people in Yakutat, Gustavus, and Yakataga were particularly helpful throughout the field portion of the project. Special thanks go to Don and Lahoma Leishman for their support and assistance while working in the Yakataga area.

The authors would like to acknowledge the invaluable assistance and cooperation of all the Bureau employees who participated in this project in the field, laboratory, and office. Robert A. Enos, Edward P. Klimasauskas, Matthew S. Nelson, and Nathan J. Rathbun ably and professionally assisted acquisition of the samples in the field. Robert L. Clifford, Robert A. Enos, Ferril R. Jacobson, Jerold L. Johnson, Jesse W. Price, Eddy L. Sullivan, Raymond P. Van Wagoner, and Joan H. Williams independently performed enormous amounts of laboratory work under demanding time constraints. Cathy A. Summers assisted in the mineral characterization studies. Jerry L. Kouzes skillfully constructed the computer-generated illustrations. Jerold L. Johnson, Cheryl L. Mardock, Steven A. Fechner, and Mark M. Meyer critically reviewed the manuscript. Completion of this project entailed the cooperation of the Bureau of Mines Salt Lake City (UT) and Albany, (OR) Research Centers, the U.S. Geological Survey National Center, Reston (VA), and the Bureau of Mines Alaska Field Operations Center, Anchorage (AK).

INTRODUCTION

Background

This report presents the results of an investigation of potential titanium (Ti) and associated heavy-mineral resources in the coastal region of the eastern Gulf of Alaska. This area was selected for study on the basis of results of previous reconnaissance studies, on information contained in the U.S. Bureau of Mines Minerals Availability System (MAS) database, and on anomalous Ti occurrences shown by regional geochemical surveys of stream sediment samples.

The principal objectives of this study include: (1) identification and characterization of titanium and associated heavy-mineral resources; (2) evaluation of potential and identified resources; (3) compilation of a report summarizing results of the investigation; and (4) updating of the MAS data base with the results of the investigation.

During 1992, ground-based fieldwork was conducted along the shorelines near Cape Yakataga and Yakutat. In 1993, helicopter-supported fieldwork was continued along the coast from Cross Sound, at the southeastern end of the study area, to the Kaliakh River, at the northwestern end.

Titanium: commercial sources and applications

Titaniferous placer deposits in unconsolidated sediments, both of the fluvial and beach-complex (including beach, eolian dune, inlet, and washover-fan deposits) types, are the source of most of the world's production of ilmenite, rutile, zircon, and monazite. Other heavy minerals, including sillimanite, kyanite, and andalusite, which are used as refractories; staurolite, which is used as a Portland cement additive and abrasive; and tourmaline and garnet, which are used as abrasives, are common byproducts and (or) coproducts of placer mining operations.

Locally, gold, platinum-group metals, cassiterite, spinel, apatite, beryl, corundum, and olivine are present in trace quantities. Other heavy minerals such as magnetite, chromite, amphibole, pyroxene, epidote, biotite, limonite, siderite, and pyrite are generally only minor constituents and are viewed by industry as diminishing the value of a deposit.

Titanium is the ninth most abundant element in the Earth's crust and occurs in many oxide and silicate mineral species (table 1). Only two of these minerals contain enough Ti to be of (current) commercial importance: ilmenite (and its alteration product leucoxene), and rutile. Ilmenite (theoretically 52.7 weight percent TiO_2) in placers often has TiO_2 contents as high as 70 percent because iron has been removed by oxidation and leaching. Rutile is also generally present in placers, and is theoretically 100 percent TiO_2, although it seldom contains more than 95 percent TiO_2. Other titanium minerals occasionally found in economic concentrations are brookite, perovskite, and anatase, which are TiO_2 polymorphs, and sphene.

The modern mining industry favors low-grade, large volume deposits that can be recovered by using simple processes. When seeking large low-grade deposits having predominant ilmenite, any large accumulation of sand can be of interest. Because dredging is the most economical method of delivering sand to large volume gravity concentrating units, loose sands that can be dredged are preferred by the heavy-mineral industry.

Table 1. Titanium-bearing minerals[6]

Mineral	**Theoretical Formula**	**TiO_2 (pct)**
Oxides:		
Rutile	TiO_2	>95
Anatase	TiO_2	>95
Brookite[7]	TiO_2	>95
Ilmenite	$FeTiO_3$	52-70
Leucoxene[8]	$FeTiO_3$	70-87
Perovskite[7]	$CaTiO_3$	59
Magnetite	Fe_3O_4	0-15
Silicates:		
Sphene	$CaTiSiO_5$	41
Melanitic garnet[7]	$Ca_3Fe_2Si_3O_{12}$	0-17
Biotite	$K_2(Mg,Fe)_4(Fe,Al)_2$ - $Si_6Al_2O_{20}(OH,F)_4$	0-6
Calcic Amphiboles	$(Na,K)Ca_2(Mg,Fe,Al)_5$ - $Si_6Al_2O_{22}(OH,F)_2$	0-10
Augite	$Ca(Mg,Fe)(Si,Al)_2O_6$	0-9

Recent studies on the availability of Ti from such placers conclude that the presently viable, large, low-grade, ilmenite-dominant resources will be exhausted within the next 30 years (Fantel and others, 1986). With placer reserves decreasing and demand high, the industry is presently in a state of flux. With changing economics and technology, the titanium industry could use any of the following sources of TiO_2: (1) lateritic (Brazilian) anatase; (2) eclogitic (Italian) rutile; (3) high-TiO_2 slag (Canada, South Africa); (4) fine-grained (western Tennessee) placers; (5) perovskite (Colorado); (6) synthetic rutile from magmatic ilmenites; and (7) offshore placers.

Most economically viable titaniferous placers were deposited within the last million years or so (Quaternary age) when sea level stands were at the same elevation or above that of the present day. Placers of this type are presently deposited in modern coastal settings. Economic polymineralic placers are uncommon in older compacted sediments that are lithified or completely indurated. The apparent lack of viable deposits in older compacted sediments may be due to incomplete exploration of the geologic record, and because accumulations along river courses and on marine and lacustrine beaches are easier to locate, and are amenable to lower-cost mining and concentration. Recent age, unconsolidated deposits and occasionally slightly older and

---

[6] Data adapted from Force (1991).

[7] Minerals restricted to unusual rock types.

[8] Leucoxene is a term for altered ilmenite.

sometimes partially consolidated Pleistocene placers are usually the most productive sources of titanium.

The principal requirements for polyminerallic placer formation are: (1) source area for heavy minerals in metamorphic and (or) igneous highland terranes (Force, 1976; Herz, 1976), (2) a fluvial drainage system that captures, transports, and hydraulically sorts the heavy minerals (for example, Slingerland, 1984), (3) a concentrating mechanism, consisting of wave, tidal, or eolian action (for example, Macdonald, 1983), and (4) the heavy-mineral budget[9] itself. These variables, coupled with ambient climatic conditions (Force and Larsen, 1986), influence the location, quality, grade, and size of the deposits.

Quaternary age deposits are found on trailing and passive margins of continents, at latitudes generally lower than 35 degrees, and are supplied by detritus mostly from high-grade metamorphic source terranes (Force, 1991). Host sands form coast-parallel surficial bodies having basal elevations that generally correspond to local Quaternary sea-level high stands. Many of the sand bodies have geomorphic expressions that represent former barrier islands and (or) eolian dunes. Sand bodies containing economic heavy-mineral placers are typically 10 m thick, 1 km wide, and more than 5 km long. Sets of sand bodies that are parallel, but not contiguous, commonly represent the strandlines on flights of marine terraces.

The minerals of economic importance are resistant to weathering (except ilmenite) and consist of ilmenite (and its alteration product leucoxene), rutile, zircon, aluminosilicate minerals, and monazite (Force, 1991). The proportions of these minerals vary considerably, and with these proportions varies the total mineral content necessary to make a deposit economic. The range of total heavy minerals in currently economic deposits is from less than 1 percent to more than 25 percent.

Titanium in polymineralic placer deposits in Quaternary shoreline sands is of greater economic importance than that in magmatic ilmenite deposits (Force, 1991). In the United States, virtually all placer production and 36 percent of identified resources are in shoreline placers. Equivalent figures for the world are about 55 and 45 percent, respectively. Individual shoreline placers can contain tens of millions of tons of TiO_2 minerals. The advantage provided by loose, well-sorted sediment with uniquely attractive mineralogy is difficult to counter, even with a rock of much higher TiO_2 grade.

Titanium, in the form of TiO_2, is primarily used for pigments (fig. 1). Its whiteness, high refractive index, and nontoxic nature make it an excellent whitening agent for paints, paper, rubber, plastics, textiles, and so forth. Titanium metal is also important in the defense and aerospace industries because of its high strength-to-weight ratio and its resistance to corrosion. Small quantities of TiO_2, in the form of rutile, are used for welding rod coating. Ceramic capacitors for electronics also use small quantities of titanium. The abundance of ilmenite and the scarcity of rutile has led to the process of upgrading ilmenite to a low-Fe, high TiO_2 (90 to 97

---

[9] Budget is used here in the sense of Force (1991), where a finite supply of heavy minerals is stated to exist in the "sedimentary budget".

percent) product called synthetic rutile.

Most rutile is mined from former shoreline placer deposits in Australia, Sierra Leone, and the Republic of South Africa (Fantel and others, 1986).

Richards Bay Slag is a coproduct of pig iron production from heavy-mineral sand concentrates in South Africa that contain 40 percent TiO_2. The slag contains from 85 to 87 percent TiO_2 and is used in both the chloride and sulfate pigment-producing processes (Fantel and others, 1986).

Lode ilmenite ore, grading about 32 percent TiO_2 from the Allard Lake Mine in Canada is arc-smelted to produce pig iron and a slag with 80 to 85 percent TiO_2, known as Sorel slag (Fantel and others, 1986).

From an economic standpoint, zircon is the most important byproduct from polymineralic placers. Zircon is used in refractories, pigment glazes, foundry sand, alloys, explosives, lamp filaments, and special magnets. Monazite is recovered for its thorium (Th) and rare-earth element (REE) contents. Some REE are color-producing elements in television tubes. Garnet is sometimes recovered, depending on market conditions, and is used almost exclusively as an abrasive. Sillimanite and kyanite are aluminosilicates that are interchangeable for most uses as ceramic refractory ingredients. Because sillimanite and kyanite are abundant and other minerals can be used in their place, in some operations they are rejected in tailings.

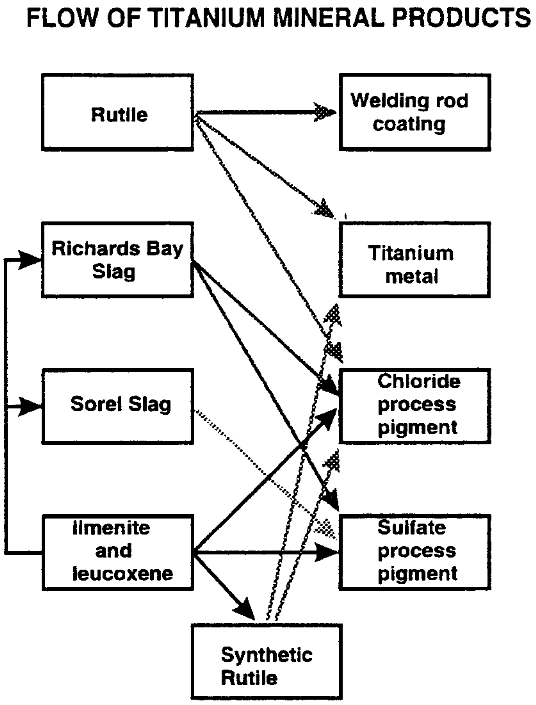


Figure 1. -- Chart showing the flow of titanium mineral products. Adapted from Fantel and others (1986).

TiO_2 pigment production and quality of TiO_2 plant feed materials

Lynd (1985) indicated that only about 5 percent of the world's annual production of titanium minerals is used to make titanium metal: the other 95 percent is used primarily for pigment manufacturing, and to a much lesser extent, for welding rod coatings and other applications. TiO_2 pigment is produced commercially by sulfate and chlorination processes that require different raw materials. In the sulfate process, ilmenite or titanium slag is treated with sulfuric acid, a portion of the iron sulfate is crystallized and removed, and the titanium hydroxide is precipitated by hydrolysis, filtered, and calcined. In the chlorination process, rutile is converted to titanium tetrachloride by chlorination at very high temperatures in the presence of petroleum coke. All United States commercial chloride-process plants use fluid-bed chlorinators, although static-bed systems can be used (Lynd, 1985). Rutile is the preferred raw material for making titanium tetrachloride, although some ilmenites and, recently, titanium slags have been used as feed. Technical considerations in both these processes dictate major and trace element specifications that need to be met in the feed material (table 2).

Table 2. Typical specifications for ilmenite concentrates for sulfate and chloride process pigment manufacturing[10]

Oxide	**Sulfate**	**Chloride**
TiO_2	45-58%	50-60%
FeO	10-40%	10-35%
Fe_2O_3	5-27%	5-27%
Cr_2O_3	0.01-0.1%	0.1-0.2%
V_2O_5	0.01-0.15%	0.01-0.3%
Al_2O_3	0.2-1.2%	0.1-0.6%
SiO_2	0.1-0.5%	0.1-0.5%
MnO	0.1-3.0%	0.1-1.0%
CaO	0.01-1.0%	0.01-0.02%
MgO	0.01-?%	0.01-0.04%
Nb_2O_5	0.04-0.2%	NA
P_2O_5	0.01-0.2%	0.01-0.1%
ThO_2	<200ppm	<200ppm
U_3O_8	<10ppm	<10ppm

NA=NOT APPLICABLE

The range in TiO_2 requirements quoted for the sulfate process reflects the use of massive or rock-type ilmenite, at the low end of the scale, and, at the upper end, the use of more highly weathered ilmenites commonly found in placer deposits (Grosz, 1987). The range of FeO and Fe_2O_3 concentration dictates the digestion conditions for the sulfate process and, for the chloride process, dictates whether or not an oxidation step is required before reduction. Al_2O_3 concentration ranges are not critical for the sulfate process; however, minimum levels are preferred for treating ilmenite by the chloride method. Low SiO_2 is preferred in both processes due to potential clarification problems in the sulfate process and product quality and chlorination efficiency in the chloride process. MnO values in the higher ranges require washing and leaching

---

[10] Adapted from Grosz (1987).

of TiO_2 pulps in the sulfate method, and cause Cl_2 wastage in the chloride method. Elevated CaO values are not problematic for the sulfate process but can cause problems with bed fluidization in the chloride process. The upper limit of MgO concentration is not defined for the sulfate process, but can also cause problems with bed fluidization in the chloride process. It is preferable to have Nb_2O_5 present in the sulfate process due to its effects on pigment properties; it is not important for the chloride process, however. Excessive levels of P_2O_5 may cause process problems and have deleterious effects on quality in the sulfate process but are not important for the chloride method. Elevated ThO_2 and U_3O_8 values are not desirable for environmental reasons.

THE STUDY AREA

Location and access

The study area is situated in the coastal region of the eastern Gulf of Alaska between Cape Suckling at the northwest end and Cross Sound to the southeast (fig. 2). The study area and surrounding region are sparsely populated. People in the widely-scattered small communities subsist primarily on fishing, logging, and tourism.

There are few roads between communities in the eastern Gulf of Alaska region (fig. 2). Large airstrips make the Cape Yakataga and Yakutat areas accessible by aircraft that can carry all-terrain vehicles (ATVs), trailers, and other mechanized equipment. Yakutat, the largest community in the study area, is serviced by a commercial airport that can accommodate jet-powered passenger and cargo aircraft. At Cape Yakataga, there is a 1,500-m unpaved airstrip that can accommodate SkyVan, DC-3, and smaller propeller-driven aircraft.

During this study, ATVs were used to transport personnel, equipment, and samples over beaches, trails, and logging roads in the Yakataga and Yakutat areas. Travel of this type was restricted, in 1992, to areas between the Cape Yakataga and Yakutat airstrips and between major streams without bridge crossings. Areas not accessible by ATVs were accessed by helicopter in 1993.

Land status

Lands included in the study are administered by several agencies (fig. 3). Specific management plans exist for most areas. Federal land-management agencies include the National Park Service, Bureau of Land Management, and the U.S. Forest Service. The Alaska Department of Natural Resources administers State-owned lands.

The study area includes the coastal region designated by the State of Alaska as the Yakataga Planning Area. The Yakataga Planning Area includes the area between Cape Suckling and Glacier Bay National Park and Preserve. Within the Yakataga Planning Area, State lands include large inland and coastal tracts. The State claims ownership of most shoreline areas that are below mean high tide. Certain State lands in the study area, including a large block between the White River and Icy Bay, were designated as Mental Health Lands in accordance with Federal

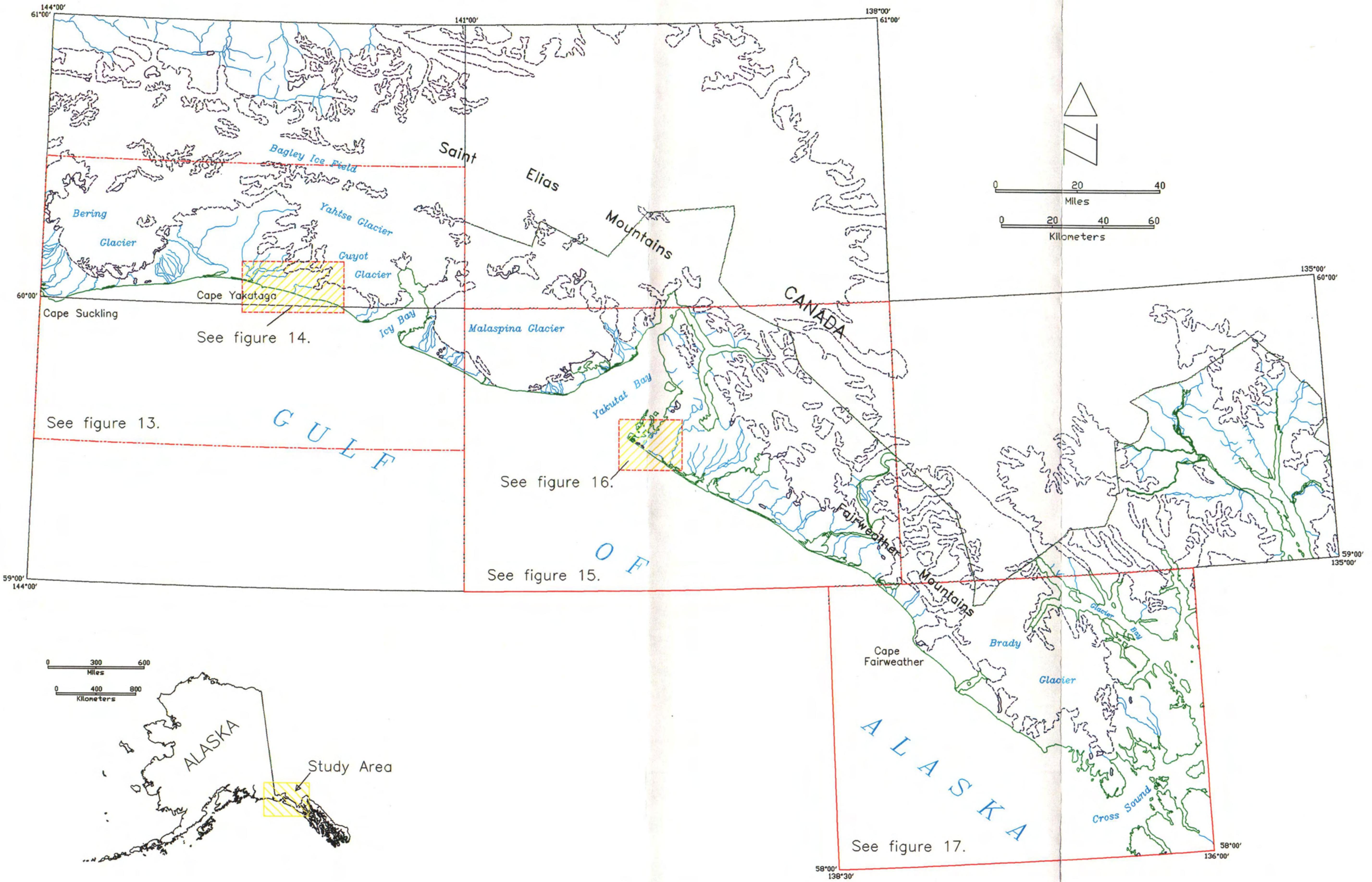


Figure 2. – Map of the eastern Gulf of Alaska showing location of the study region.

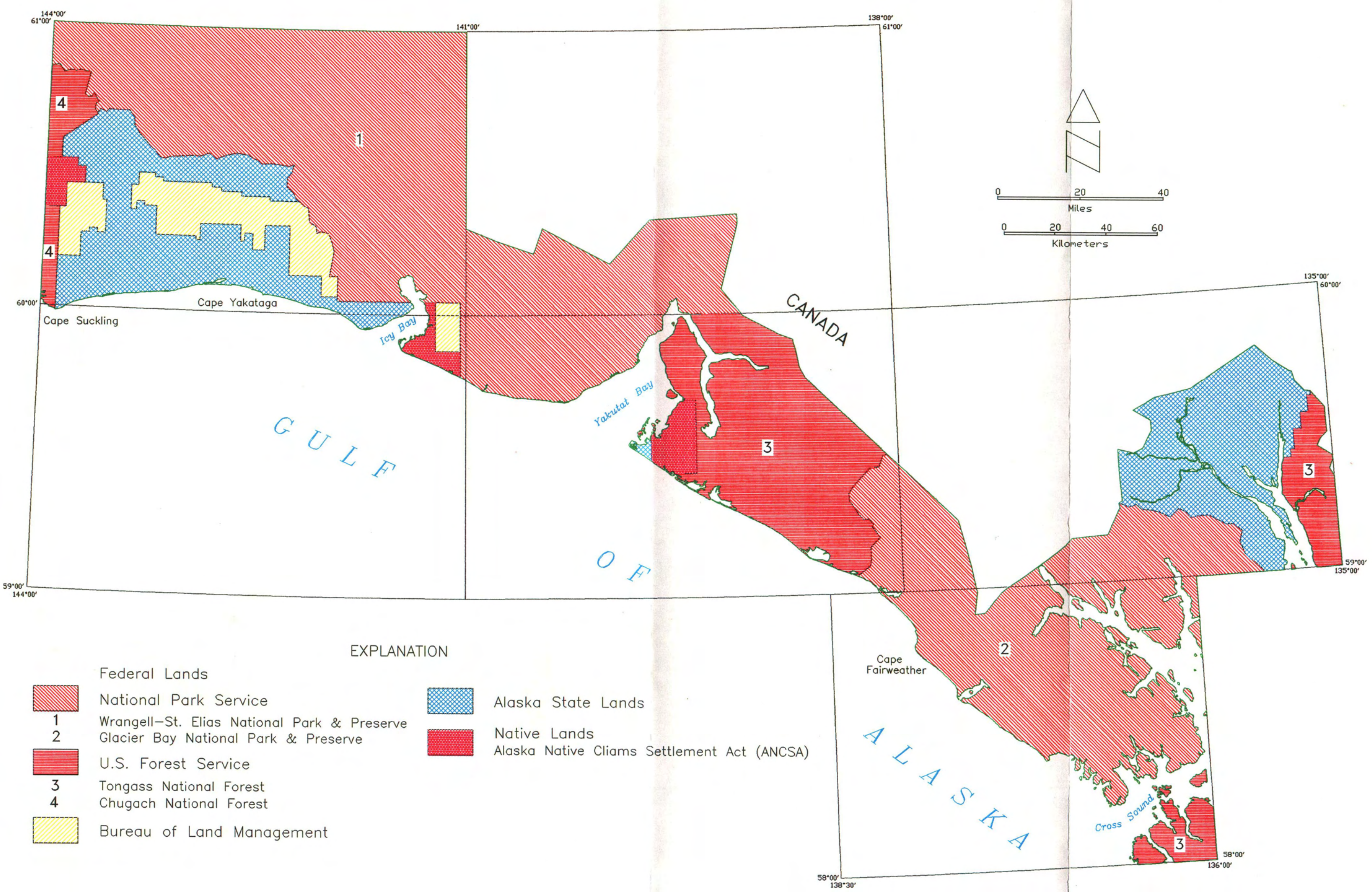


Figure 3. – Land status map of the eastern Gulf of Alaska.

legislation passed prior to Alaska statehood. Lands selected as Mental Health Lands were designated as such on the basis of their commercial value, including their mineral potential.

Private lands are owned by Regional and Village Native Corporations. Other lands are privately owned or are claimed as mineral properties in accordance with State and Federal mining laws. Among the privately-owned lands in the region are tracts on which the University of Alaska owns timber rights.

The interested reader is encouraged to contact the above-mentioned agencies regarding land classification, ownership, and any land-use restrictions pertaining to specific lands in the study area.

Geomorphology

The eastern Gulf of Alaska region is a dynamic, high-energy coastal environment that is subject to high tidal ranges, severe winter storms, rapid sedimentation, and longshore currents. Inland of the coastline are expansive glacial ice fields, active piedmont and alpine glaciers, and rugged ice-covered mountains including the Saint Elias and Fairweather Mountains (fig. 2). The coastal plain varies in width from greater than 20 km at its widest stretches in the Cape Suckling-Icy Bay and Yakutat Foreland areas to less than a kilometer at Cape Yakataga and between the shoreline and the Fairweather Mountains at the southeastern end of the study area. The coastal plain is covered by glacial ice at the terminus of Malaspina Glacier and nearly so in the vicinity of the Bering and Guyot Glaciers.

Expansive areas of glacial drift cover the coastal plain near the larger active glaciers and on the Yakutat Foreland where glacial ice has retreated to more than 20 km from the modern coastline. Fjords and other features that show the erosional effects of recent piedmont glaciers along the coast include Icy Bay, Yakutat Bay, Lituya Bay, and Cross Sound. As a result of glacial retreat and glacial debris transport along the coastline, the position and shape of Icy Bay and nearby recessions in the coastline have changed dramatically in historic and modern times (Molnia, 1977). Between 1904 and 1976, the glacier that once filled Icy Bay receded more than 40 km. Conversely, in 1794, a second bay, formerly located east of present-day Icy Bay, was open but is now completely filled by glaciomarine deposits.

The modern coastline undergoes dramatic seasonal and sometimes daily changes. Extreme topographic relief, widespread active glaciers, and abundant precipitation result in enormous sediment load being deposited into the high-energy coastal environment. Also, erosional processes dramatically affect the morphology of the modern beach. Following periods of rainfall, washouts as deep as several meters occur along the steeply sloping beaches in the Cape Yakataga area.

Beaches in the study area range from short to long stretches of well-sorted sandy or gravelly sand to sandy boulder beaches. Pebbles are typically worn flat by wave action and storm wave-transported glacial boulders are spheroidal.

Back beach areas are characteristically bounded by wave-cut cliffs, behind which are forested areas. Exposed in the cliffs are a full range of sedimentary deposits and structures that are characteristic of high energy coastlines. These include sorted and stratified storm wave sand

and pebble concentrations and logjams. Deposits that formed in calmer settings include nearshore channel deposits, washover fan, estuary, and mudflat deposits. In some modern back beach areas are active dune fields. Inland of other areas are older vegetated dune fields. Numerous sets of forested terraces show the combined effect of raised sea level in the geologic past and tectonic uplift in recent to modern times (Yehle, 1979).

Geologic setting

The Gulf of Alaska region is within a tectonically active and geologically immature convergent to translational plate margin setting in southern and southeastern Alaska (Bruns and Plafker, 1975, and Yehle, 1979). The region comprises an accretionary complex containing numerous lithotectonic terranes that were joined to the proto-North American tectonic plate during Late Paleozoic through Mesozoic time (Brew and others, 1978). Descriptions and maps showing the disposition of the lithotectonic terranes in the region are contained in Jones and others (1987) and Monger and Berg (1987). A comprehensive geologic map of the study area was compiled by Plafker (1967). The geology of the area of this investigation is well summarized by Reimnitz and Plafker (1976).

The Chugach-Saint Elias, Fairweather, and Border Ranges fault systems (fig. 4) strike roughly parallel to the Gulf of Alaska coast and form important structural boundaries between geologically and physiographically distinctive terranes (Reimnitz and Plafker, 1976). In general, the rugged mountainous terrane north and east of these faults is underlain by crystalline igneous and metamorphic rocks, whereas the adjacent foothills and coastal-plain belt to the south and west is underlain largely by Cretaceous and Cenozoic bedded sedimentary rocks with associated small bodies of intrusive rocks.

The rocks exposed in and adjacent to the report area may be broadly divided into three major lithologic sequences that are separated by unconformities and that differ considerably in age, lithology, degree of deformation, and topographic expression (Reimnitz and Plafker, 1976). The oldest sequence is a crystalline complex consisting of a diverse assemblage of late Paleozoic(?) and Mesozoic mica schist, volcanic rocks and marble metamorphosed to high-grade greenschist to amphibolite facies. This complex lies to the north and east of the Fairweather and Border Ranges fault systems.

The second sequence is a slightly metamorphosed, eugeosynclinal sequence of late Mesozoic age (Yakutat and Valdez Groups) that is metamorphosed to zeolite or amphibolite facies and is characterized by abundant volcaniclastic detritus, intense deformation, and tectonically intermixed rock fragments and blocks of widely diverse origin and age (melange). This sequence is intruded by the Tertiary age Fairweather, Crillon-La Perouse, and Astrolabe-DeLangle layered mafic plutons, between the Fairweather and Border Ranges faults.

The youngest sequence comprises mildly to strongly deformed continental and marine sedimentary rocks at least 12,000 m thick that range in age from Paleocene through Pleistocene (Reimnitz and Plafker, 1976). This sequence is further broadly divisible into a lower unit of well-indurated, strongly deformed marine and continental coal-bearing rocks of Paleocene through

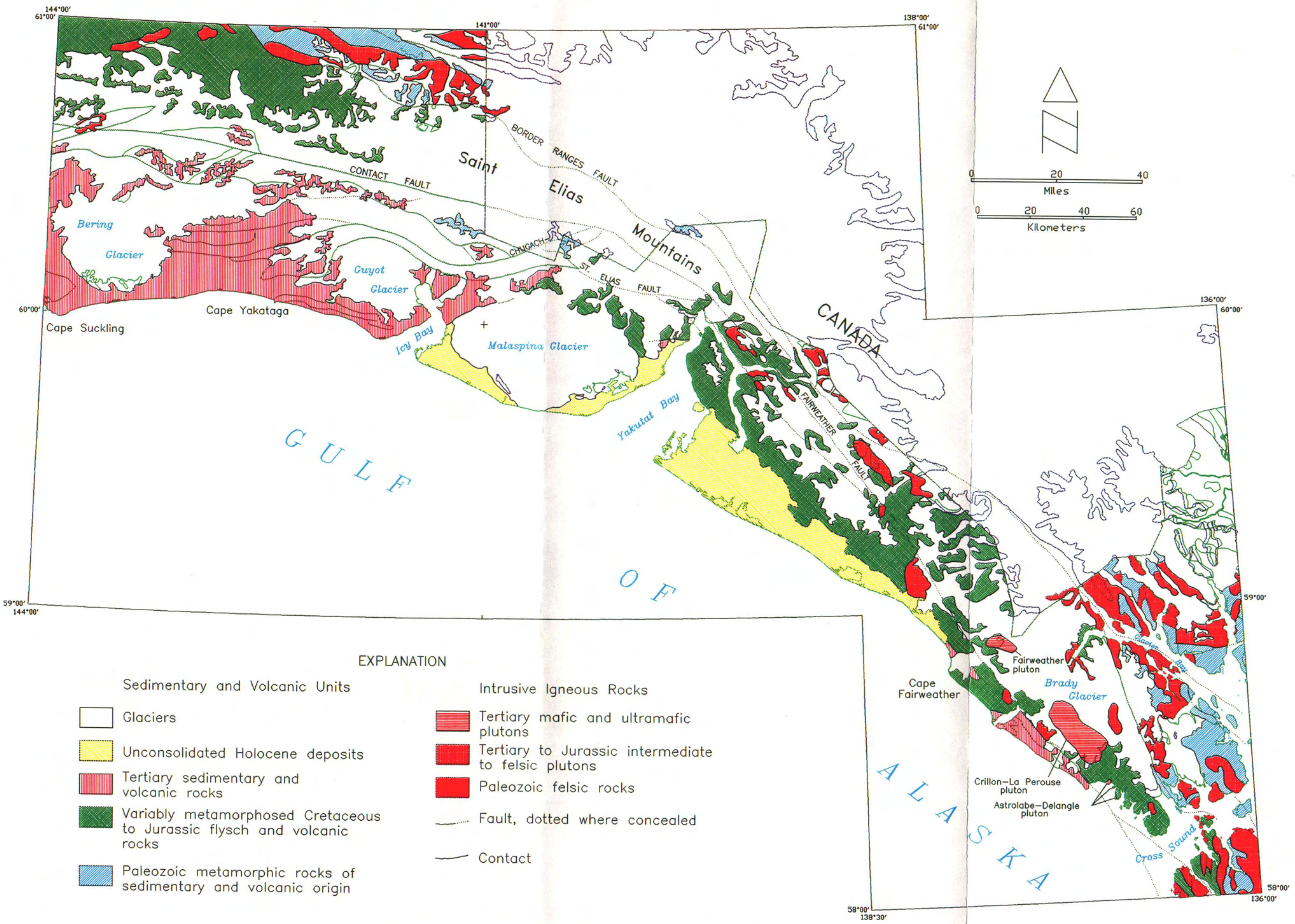


Figure 4. Simplified geologic map of the eastern Gulf of Alaska.

early Oligocene age (Kulthieth Formation); an overlying unit of less deformed and less-indurated marine clastic and volcanic rocks of Oligocene and early Miocene age (Poul Creek Formation); and a thick upper unit of slightly to moderately deformed marine clastic rocks characterized by abundant glacial detritus (Yakataga Formation) that ranges in age from middle Miocene through early Pleistocene.

The two older bedded sequences are intruded by numerous quartz diorite, granodiorite, and adamellite (quartz monzonite) plutons that range in age from middle Jurassic to middle Tertiary (Reimnitz and Plafker, 1976). Numerous small aplite and pegmatite dikes are associated with some of the granitic plutons, and the plutons locally have extensive aureoles of migmatite or hornfels. In addition, widely scattered smaller intrusive bodies of Tertiary age cut both the pre-Tertiary and Tertiary sequences. These include lamprophyric to diabasic mafic dikes and plugs and rare stocks, plugs, and dikes of quartz porphyry.

The Tertiary and older formations in the Gulf of Alaska region are overlain unconformably, at most places with marked angular discordance, by flat-lying unconsolidated surficial deposits that are largely, if not entirely, of Holocene age (Reimnitz and Plafker, 1976). These deposits are both marine and terrestrial in origin and are thickest and most extensive on the coastal lowland and on some elevated marine terraces (Qh, fig. 4). They have been subdivided and extensively described by Miller (1951, 1953, 1957, 1961, 1971, 1975, and so forth) and other geologists.

In the coastal region, the major unconsolidated sediment types, classified according to lithologic character and origin, are (1) well-sorted sand and gravel formed at or near the present beach and on former beaches, including strand lines elevated by Holocene tectonic uplift; (2) well-sorted dune sand on or near the present or former beaches; (3) interbedded mud and sand containing much organic debris, which were formed on tidal flats, in bays or lagoons, and in clear lakes and swamps; and (4) interbedded mud and poorly sorted to moderately well-sorted sand and gravel, which were formed on the flood plains or fans of streams on the outwash aprons of glaciers, including terminal and ground moraine and ice-rafted deposits.

The thickness of the unconsolidated deposits on the coastal lowland and along the raised beach ridges is not well known. Data from oil-company exploratory wells and seismic reflection profiling indicate that the unconsolidated deposits are commonly up to a few hundred meters thick (Reimnitz and Plafker, 1976 and Yehle, 1979). Marine deposits on the highest terrace (elevation up to 230 m) in the Lituya district, between Lituya Bay and Cape Fairweather, are estimated to be 15 to 30 m thick, and the deposits on an elevated terrace at the northwestern margin of the La Perouse Glacier are 3 m thick. In the Yakataga district, surficial deposits on elevated marine terraces between Icy Bay and Cape Yakataga range in thickness from less than a meter to 10 m.

Yehle (1979) provides detailed descriptions of Holocene deposits in the Yakutat area, including beach, eolian, alluvial, delta-estuarine, glacial outwash, moraine, and organic deposits, including peat. During the present investigation, it was found that, with minor deviation, unconsolidated deposits throughout the eastern Gulf of Alaska are very similar in composition and grain size to those in the Yakutat area. The youngest, or modern beach deposits include material between the sea and the beach berms. These consist primarily of pebbly sand having minor sandy pebbly cobble gravel throughout most of the region, with cobble- and boulder-dominated beaches prevailing at the terminus of piedmont glaciers and along rocky headlands at the southeastern end of the study area. Yehle (1979) states that in the Yakutat area, these deposits overlie end and ground moraines and are generally from 1 to 3 m thick. In the course of sampling for this study, ten power auger holes along 20 km of modern beach in the Yakutat area penetrated to depths ranging from 9 to 11 m without encountering moraine. Similarly, 19 of 24 power auger holes in modern deposits, along 30 km of beach in the Yakataga area, penetrated from 4 to 10 m without encountering moraine deposits. Shallower power auger holes were located in rocky areas near Cape Yakataga and Umbrella Reef. Power auger holes in older elevated shoreline deposits penetrated depths of 10 m in the Yakutat area and 4.5 to 10 m in the Yakataga area.

Regional geochemical character

The National Uranium Resource Evaluation (NURE) program gathered data to evaluate uranium resources for the United States and to identify areas potentially favorable for uranium deposits (Averett, 1984). Between 1975 and 1983, this U.S. Department of Energy program acquired stream sediment geochemistry and airborne spectral gamma-ray radiation data for the conterminous 48 States and Alaska.

The Hydrogeochemical Stream Sediment Reconnaissance (HSSR), one component of the NURE program, entailed collection and analysis of samples of sediment (stream, soil, talus, playa, and others), groundwater, surface water, and vegetation to determine concentrations of uranium and other selected elements (Arendt and others, 1980). These data helped to outline geochemical provinces and to show favorable areas for more detailed investigation. Averett (1984) gives tabulations of areas surveyed during the HSSR and the available information for those areas.

Sampling of the HSSR data was reported on 1:250,000-scale quadrangles. HSSR data reports were issued for 104 of the 153 quadrangles in Alaska. All samples were analyzed for uranium, and nearly all were analyzed for as many as 59 additional elements (Averett, 1984).

Analyses were conducted primarily by instrumental neutron activation, and the precision for all elements except U and Th was ±25 percent. This level of precision was adequate for the needs of the NURE program and is useful for regional studies, but it is less precise than the analytical quality routinely obtainable today (S. Church, U.S. Geological Survey, written communication, December 1992).

The rationale and method utilized in preparing these data for placer resource assessments are given in detail by Grosz (1993 a-c); a brief explanation is provided here for clarity. The HSSR database for each quadrangle contains information on sample types, location coordinates, various descriptive fields, and analytical data. For this report, we did not evaluate the quality of or normalize the data. We searched the data for seven quadrangles (Bering Glacier, Icy Bay, Yakutat, Skagway, Mount Fairweather, and Juneau) from southeastern Alaska for sediment samples (including wet and dry spring, stream, pond, talus, lake or reservoir, playa, and unknown sediment types) having concentrations for Ce, Dy (dysprosium), Eu (europium), Hf, La, Lu (lutetium), Sc (Scandium), Sm (samarium), Th, Ti, U, Y (yttrium), Yb (ytterbium), and zirconium (Zr).

For these quadrangles, 729 samples met the search criteria (fig. 5). For each sample,

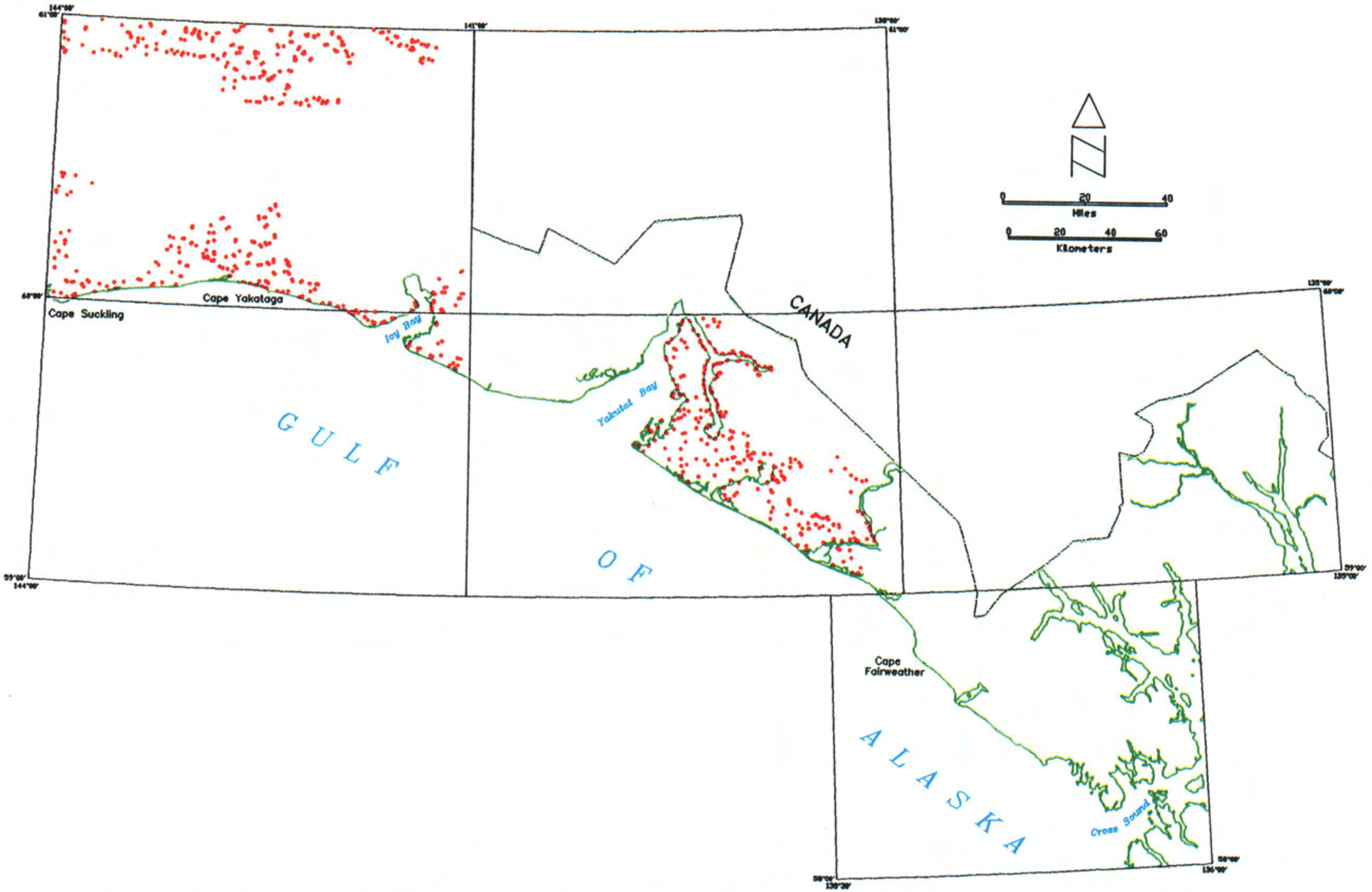


Figure 5. -- Locations of 729 NURE sediment samples in southern and southeastern Alaska.

elemental data were reported as (1) a positive number (expressed as parts per billion), (2) zero, (3) a negative number (signifying less than a given level of concentration; that is, 2,000 ppb), or (4) no value (analytical data not available). In this study only positive numbers were used; data are discussed in percent format. U and Sc were consistently reported for the samples; however, not all the REE were analyzed in every sample.

This approach is based on the hypothesis that elements such as Ti, and Hf or Zr, in stream-sediment samples indicate the presence of common economic heavy minerals such as ilmenite and rutile, in the case of Ti, and zircon, in the case of Hf and Zr. The REE are commonly associated with Y, Th, and U in heavy minerals such as monazite, xenotime, and allanite. Because Zr and Hf possess extraordinary geochemical affinity for each other, they usually indicate the presence of zircon (Vlasov, 1966). Although other commonly occurring heavy and light mineral species can carry these elements as well (for example Ti, Hf, and Zr in amphiboles, Zr and Hf in pyroxenes, and REE, U, and Th in apatite), they typically contain only trace abundances of these elements.

NURE titanium distributions are shown to be consistent with known titanium oxide (ilmenite, rutile, and so forth) occurrences (Grosz, 1993a-c). Titanium occurrences, however, may not always be present as ilmenite or rutile. This consideration could be important especially in regions of the United States where sphene, magnetite, and titanium-augite, for example, may be common in soils and sediments.

Figure 5 displays the distribution of 729 sediment sample sites in the study area. Figure 6 displays the relation between Ce and La concentrations for 675 samples having both Ce and La data. The R^2 is 0.83. The average Ce:La ratio of this population is 2.14:1 in a range from 1.27:1 to 5.33:1. Overstreet (1967) states that the monazite in the southeastern United States has a Ce:La ratio of about 2.1 to 1. The scatter shown on the diagram is probably a function of compositional variability in monazite (Overstreet, 1967). The relation between Ce and Th for 698 samples is shown in figure 7. The R^2 is 0.77 and shows that monazite controls the distribution of Th. Figure 8 displays the relation between Th and U for 700 samples. An R^2 of 0.77 indicates that monazite is also an important contributor of U. These data show that the radioactivity of the sediments in the Cape Yakataga area is controlled by monazite rather than zircon as was suggested by Moxham and Nelson (1952).

Zircon occurs in igneous, metamorphic, and terrigenous clastic sediments. The presence of zircon in this area is also indicated by the HSSR geochemical data. Figure 9 displays the relation between Zr and Hf for 685 samples. The Zr:Hf ratio for zircons generally varies from 15 to 150 (Vlasov, 1966); for this suite of samples the average Zr:Hf ratio is about 28. The R^2 for this relation is 0.98. Zr and Hf also occur in dispersed form in titanium minerals, olivine, garnet, amphibole, and pyroxene (Vlasov, 1966) and thus may contribute to the scatter.

The relation between Ce and Th shown in figure 7 shows that Th-rich monazite is the source for Th. The relation between Th and U (fig. 8) suggests that monazite is also a principal source of U. Monazite controls the distribution of Th, and therefore the radioactivity, of the sediments in this region.

Anomalous outliers in the geochemical data for the study area were defined by the upper 10 percentile of each element group. This approach yielded 72 samples with REE from greater than 0.013 to 0.06 percent, 72 samples having Ti from greater than 0.70 to 3.79 percent, and 71 samples having Zr from greater than 0.03 to 2.52 percent. Figures 10, 11, and 12 show

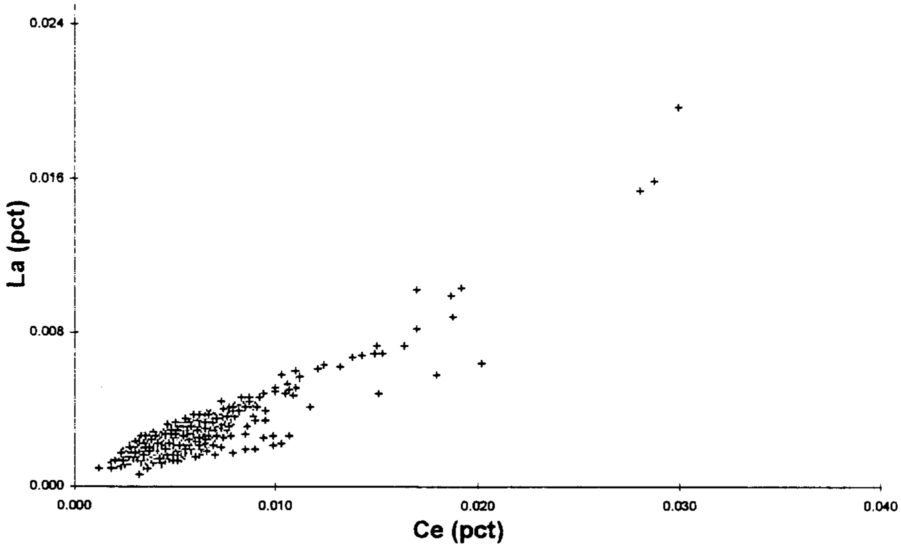


Figure 6. -- Graph of La:Ce ratios for NURE sediment samples.

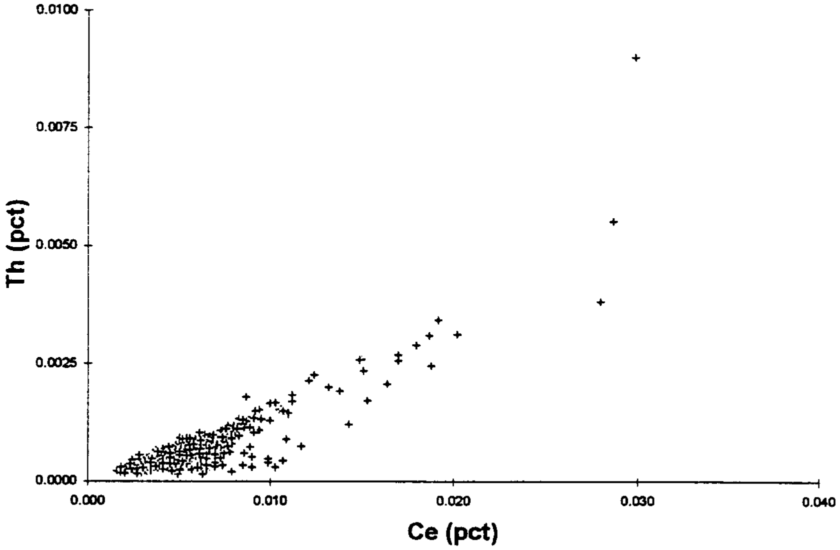


Figure 7. -- Graph of Th:Ce ratios for NURE sediment samples.

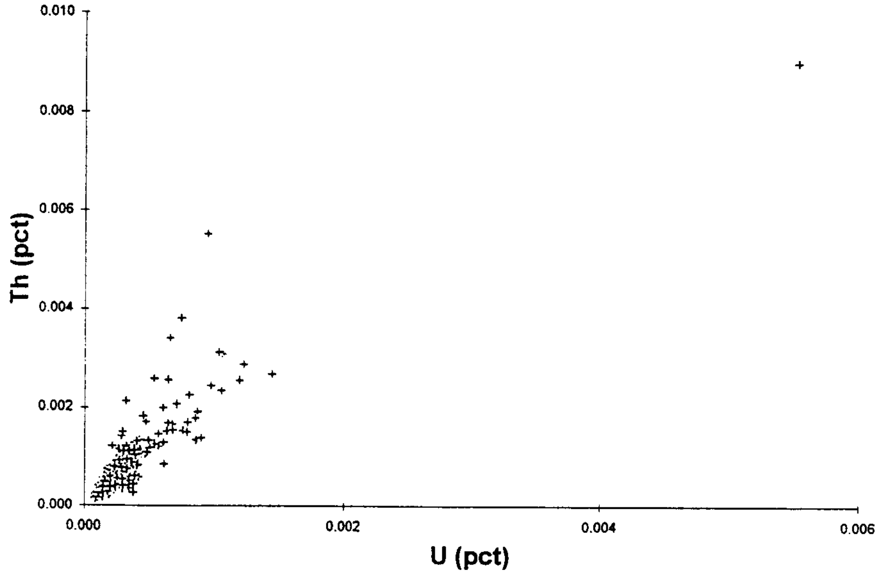


Figure 8. -- Graph of Th:U ratios for NURE sediment samples.

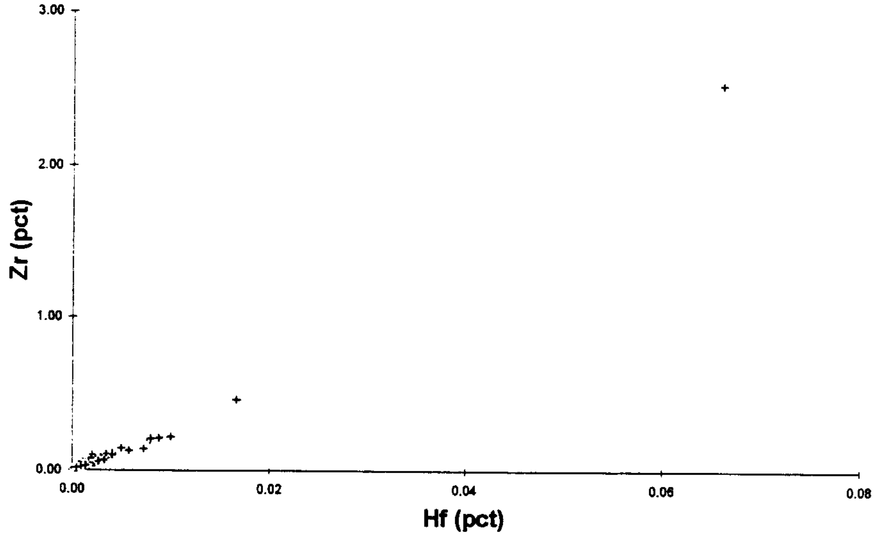


Figure 9. -- Graph of Zr:Hf ratios for NURE sediment samples.

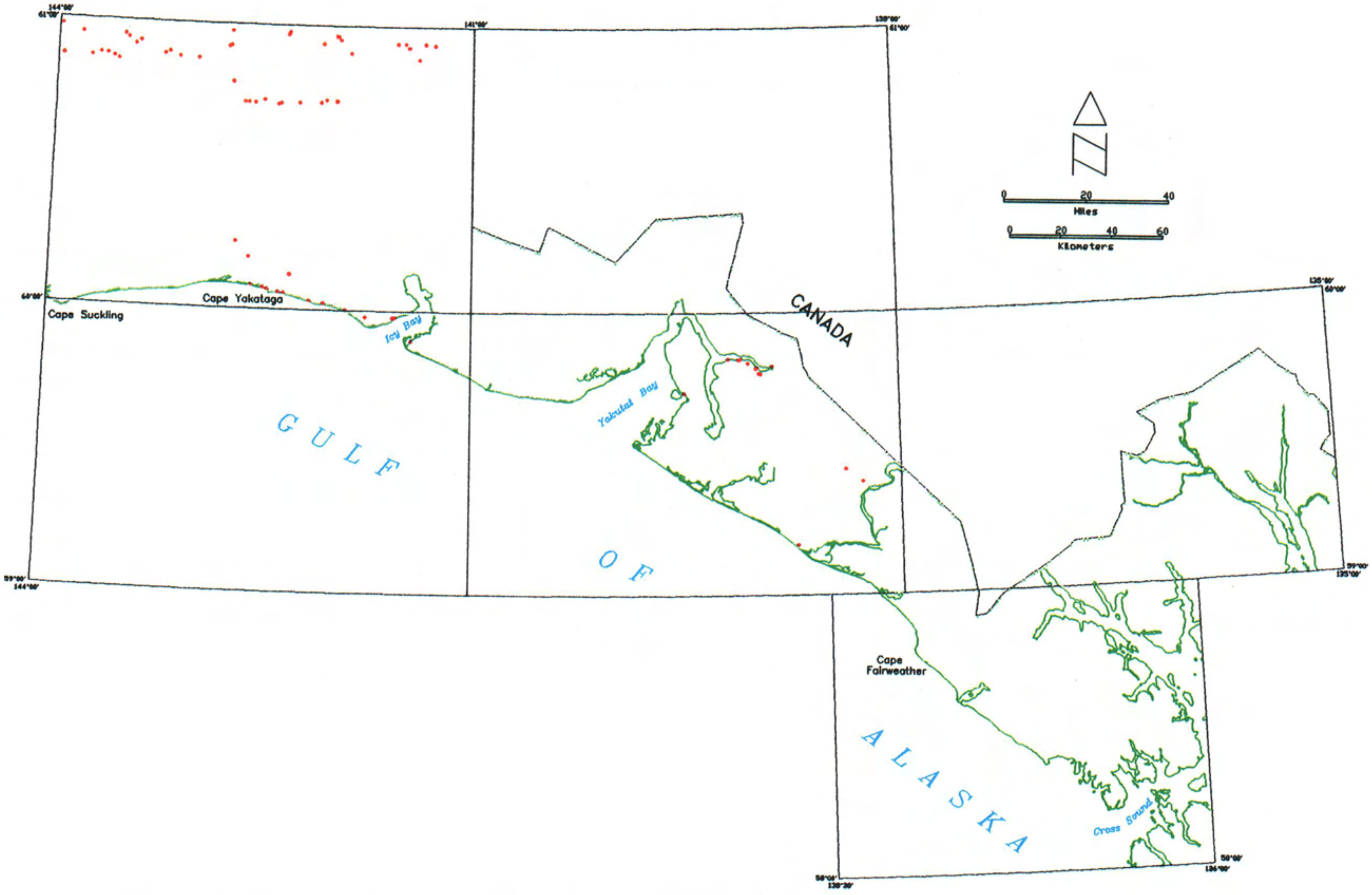


Figure 10. -- Locations of NURE sediment samples with anomalous rare-earth elements.

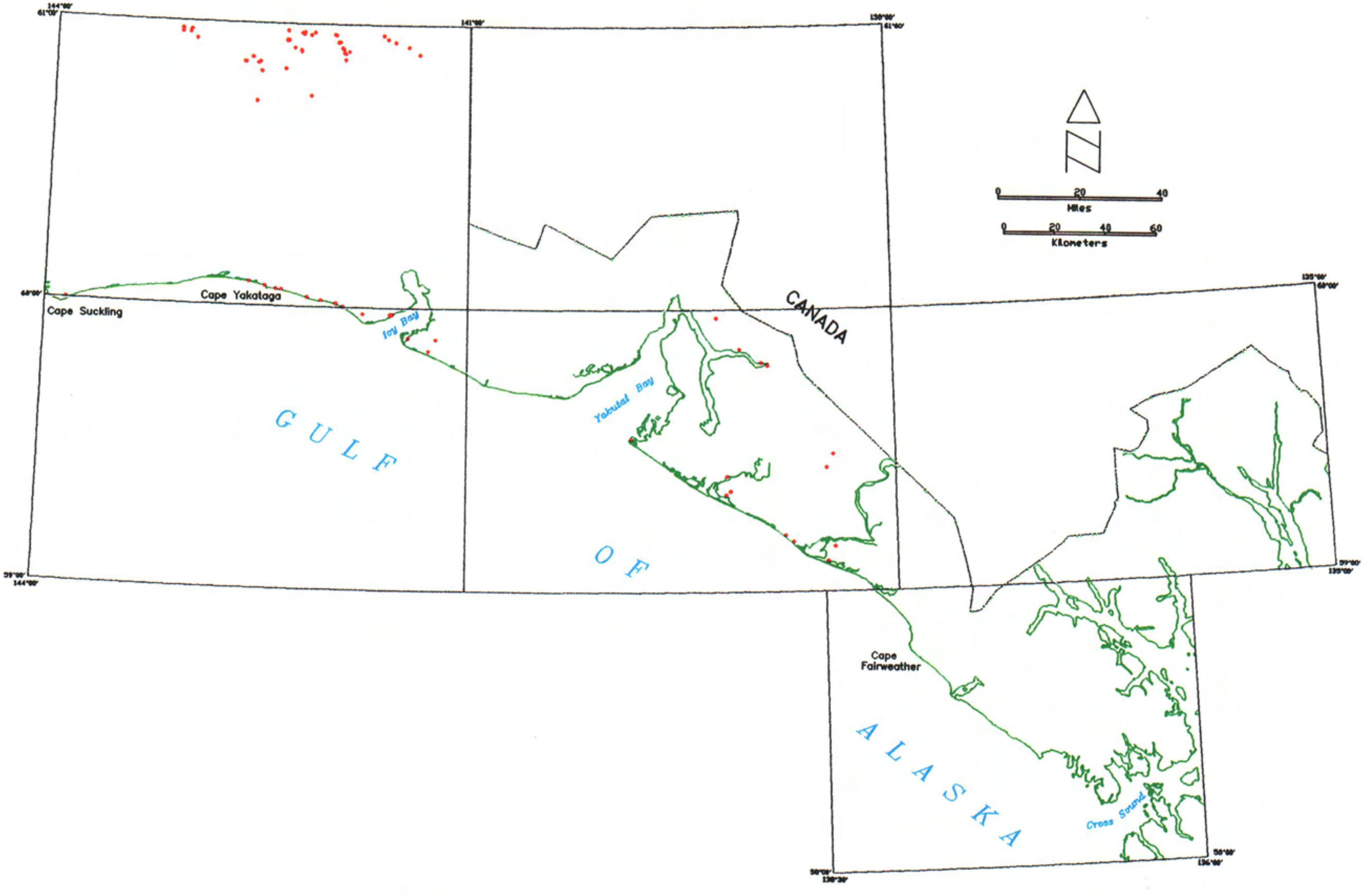


Figure 11. -- Locations of NURE sediment samples with anomalous titanium.

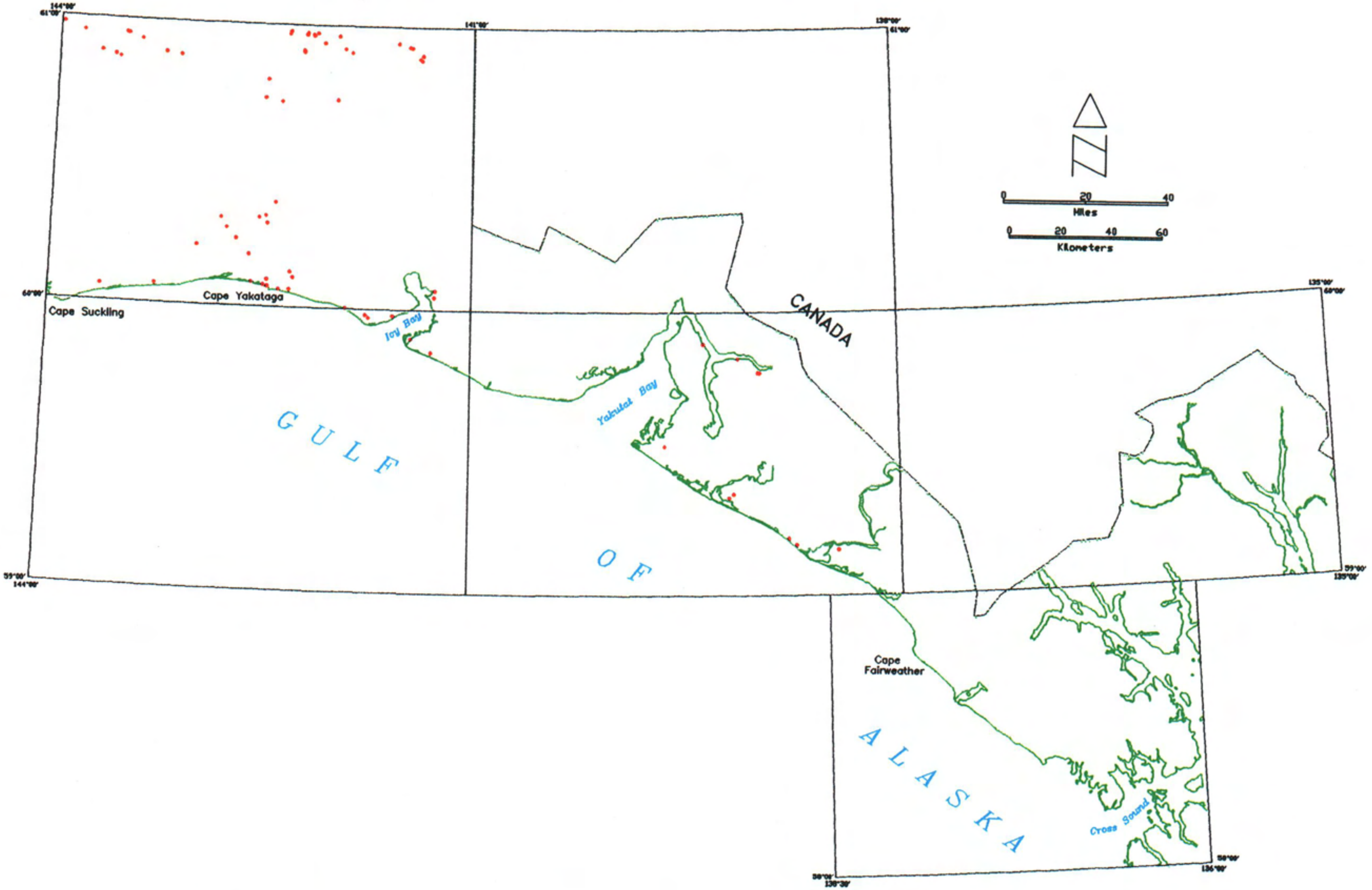


Figure 12. -- Locations of NURE sediment samples with anomalous zirconium.

locations of samples with anomalous REE, Ti, and Zr, respectively. These data define (1) source rocks or possible placer deposits and (2) anomalous concentrations of heavy minerals in sediments that may indicate heavy-mineral deposits. The anomalous locations, particularly those associated with beach sediments provide supporting evidence for the presence of potentially economic concentrations of placer heavy minerals in the study area.

Mining history

Mineral production in the eastern Gulf of Alaska region has been limited to minor placer gold production. As of 1976, about 16,000 troy ounces of gold had been produced in the Yakataga area and 3,700 troy ounces in the Lituya-Yakutat area (Reimnitz and Plafker, 1976). Tarr (1905) and Tarr and Butler (1909) described early and mostly unsuccessful attempts to produce gold in the Yakutat area. Maddren (1914) described what was known in 1913 of the placer gold deposits in the Yakataga area. Production in the area waned after 3,600 ounces were produced in 1917 (Thomas and Berryhill, 1962). Subsequent exploration projects and mining ventures were conducted by private concerns but few details are publicly available. Annual production figures for the Yakataga area, ranging from several to 200 ounces, are recorded for the period from 1921 to 1969. Since then, numerous companies and individuals have intermittently explored, prospected, and mined for gold in small-scale operations. Reimnitz and Plafker (1976) and Eyles (1990) discuss the bedrock sources of the placer gold. Associated with placer gold in the region are trace quantities of platinum-group metals (Foley and others, 1989).

PREVIOUS MINERAL RESOURCE INVESTIGATIONS

Heavy minerals, other than gold in beach sand deposits, have been investigated and prospected for less rigorously than for gold. Nine drill samples from the Yakataga area were examined for uranium minerals, but the observed radioactivity was attributed by the investigators to thorium-bearing zircon (Moxham and Nelson, 1952). During 1955 and 1956, beach deposits near Yakataga were prospected and drilled by private concerns for radioactive minerals (Thomas and Berryhill, 1962). In 1957, private concerns examined heavy-mineral-bearing sands for magnetite in the Yakutat and Lituya Bay areas with churn drills. Thomas and Berryhill (1962) conducted a reconnaissance study of heavy-mineral beach sand deposits and effectively delineated the eastern Gulf of Alaska heavy-mineral province. An aeromagnetic survey of the Yakutat foreland was conducted to attempt a definition of magnetite-bearing heavy-mineral concentrations in unconsolidated beach deposits, but magnetic anomalies were found to correlate with bedrock features rather than surficial deposits (Johnson and Plafker, 1969). Cook (1969, 1975) and Hwang (1974) designed bench-scale systems for the beneficiation of heavy minerals in samples from Cape Yakataga beach sands and other sites in Alaska. Contained in those reports are screen size analyses, gold size analyses, gold flotation, and heavy-mineral assay data. The USGS and the

Bureau evaluated beach sand deposits in Glacier Bay National Monument for ilmenite and gold content (Brew and others, 1978). Clifton and Luepke (1987) summarize the available literature pertaining to heavy-mineral placers of the entire continental margin of Alaska.

Numerous USGS projects focused on petroleum potential in the Gulf of Alaska Tertiary province (Miller, 1951-75, Miller and others, 1959, Bruns and Plafker, 1975, and Plafker, 1971). More than a dozen oil seeps are present in the Yakataga area (Maddren, 1914) and more than 50 exploratory wells were drilled throughout the entire province. Production in the region amounted to 154,000 barrels from the Katalla District, to the west of the present study area (Miller and others, 1959).

Other USGS reports deal with lode mineral resources in the region. Reports by Cobb (1972a-c) show the locations and contain references that pertain to mineral occurrences in the Bering Glacier, Icy Bay, and Yakutat 1:250,000-scale quadrangles. MacKevett and Plafker (1970) conducted a geochemical and geophysical reconnaissance of the Yakutat and Fairweather Quadrangles. Brew and others' (1978) mineral resource investigation of the Glacier Bay National Monument dealt with bedrock mineral occurrences as well as the above-mentioned beach deposits. Undeveloped metallic mineral resources including nickel, copper, platinum-group metals, ilmenite, rutile, chromite, apatite, and magnetite in the Crillon-La Perouse and Fairweather layered gabbro complexes are described by Rossman (1963), Plafker and MacKevett (1970), Czamanske and others (1981), and Himmelberg and Loney (1981).

PRESENT STUDY

Field methods

Five hundred and forty-six samples were collected to assess the heavy-mineral content of beach complex sediments in the area of this study. Field sample numbers, map numbers, and intervals sampled are given in Appendix A. Sample location coordinates (figs. 13-17) were determined by use of topographic maps and global positioning system (GPS) receivers. Samples were collected from shoreline deposits, inland marine and nonmarine deposits, and from some of the rivers. The 546 samples include 160 solid-stem power auger, 305 hand auger, 1 grab of high-grade surface concentration of heavy minerals, and 11 grab samples from beach face, dune, washover fan, estuarine, and other nearshore deposits. The remaining samples include 50 channel samples from wave-cut terraces exposed at back-beach areas, 15 river sediment, 3 pan concentrate, and 1 indurated sandstone sample. Gross wet sample weights ranged from 2 to 60 kg. Samples were collected and placed into plastic bags or plastic pails with gasket-sealed lids. The gasoline-powered auger (fig. 18) used during this study was mounted on a trailer and towed behind an ATV. Auger flights measured 0.9 m long by 76 mm in diameter. Hand auger samples (fig. 19) were collected with bucket- and sand-auger bits with 1.2 m handle extensions; bit diameters ranged from 70 to 114 mm. Channel samples (fig. 20) were collected with scoops or shovels from exposed strata. Grab and high-grade concentrate samples were scooped or scraped from the surface. River sediment samples were screened and panned on site to concentrate heavy

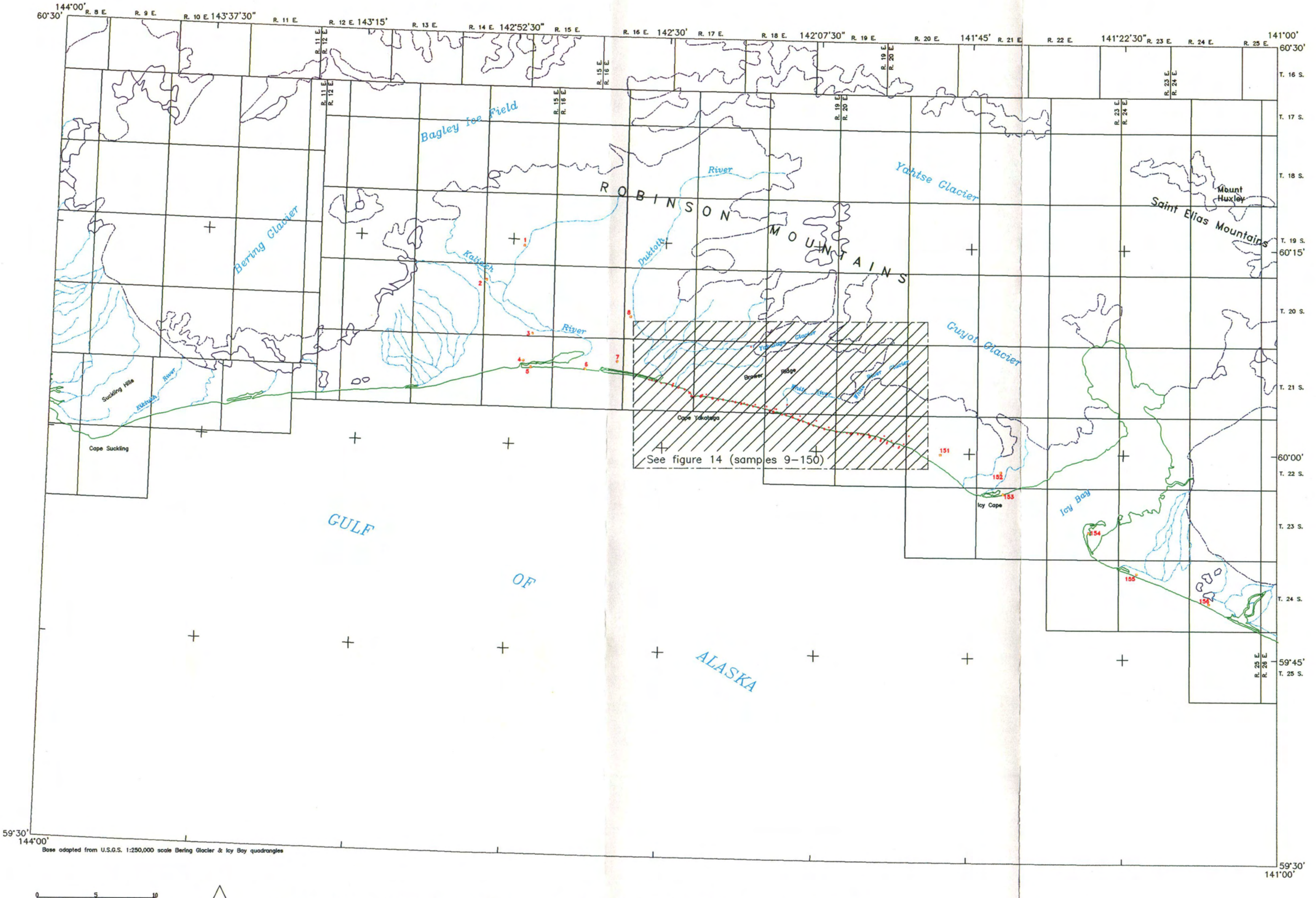


Figure 13. – Sample location map of the Cape Suckling – Icy Bay area.

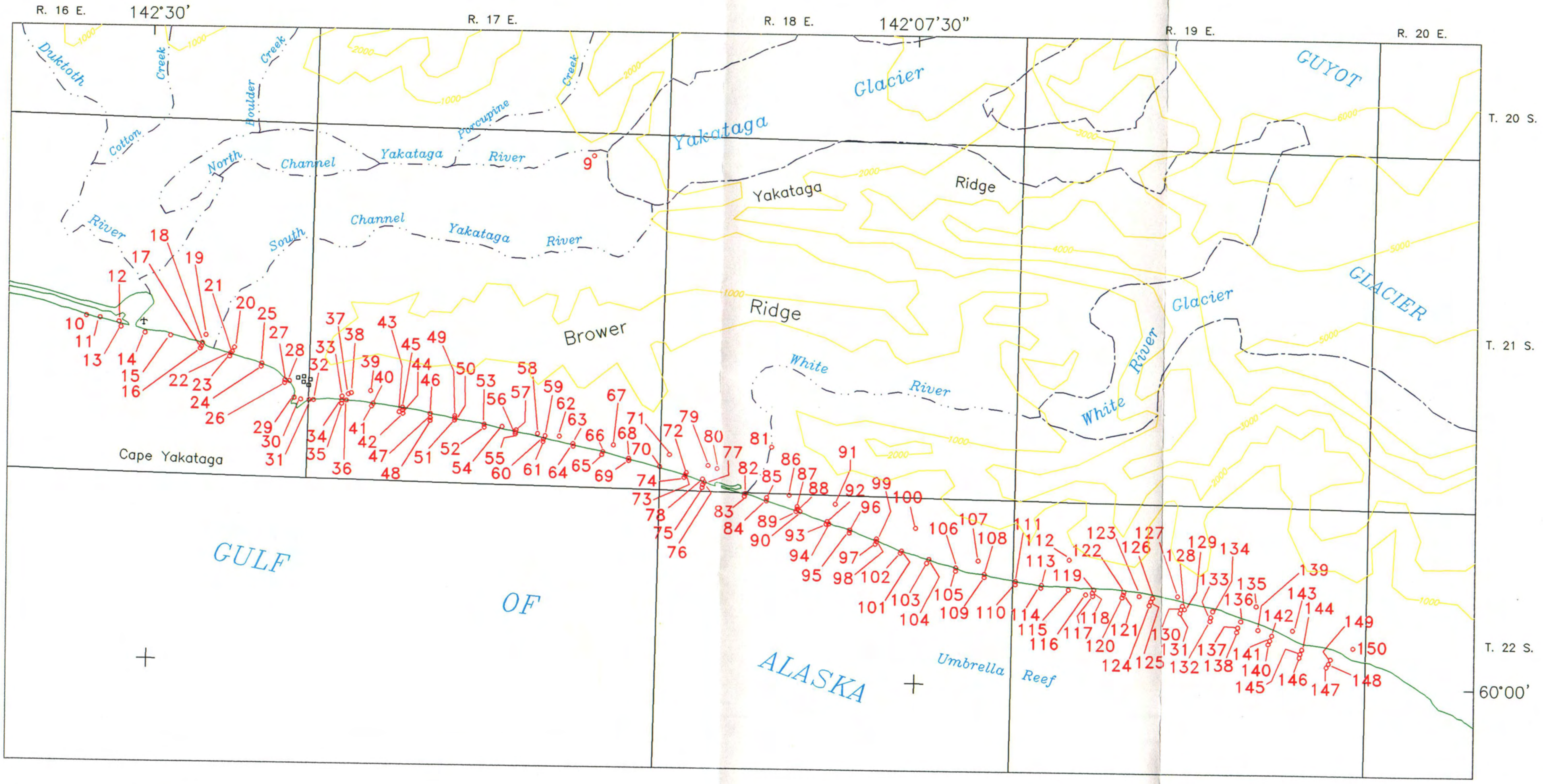


Figure 14. – Sample location map of the Cape Yakataga area.

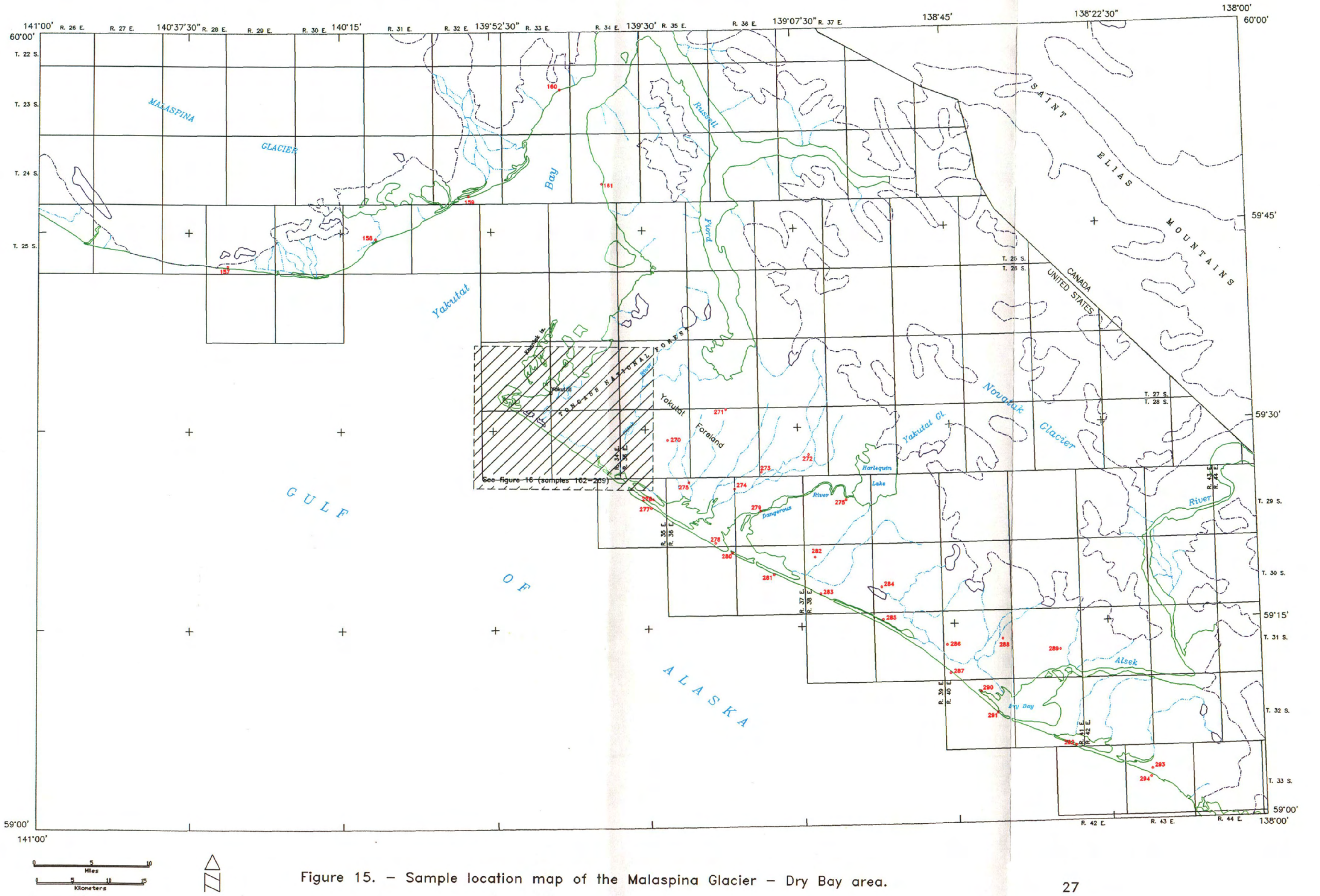


Figure 15. – Sample location map of the Malaspina Glacier – Dry Bay area.

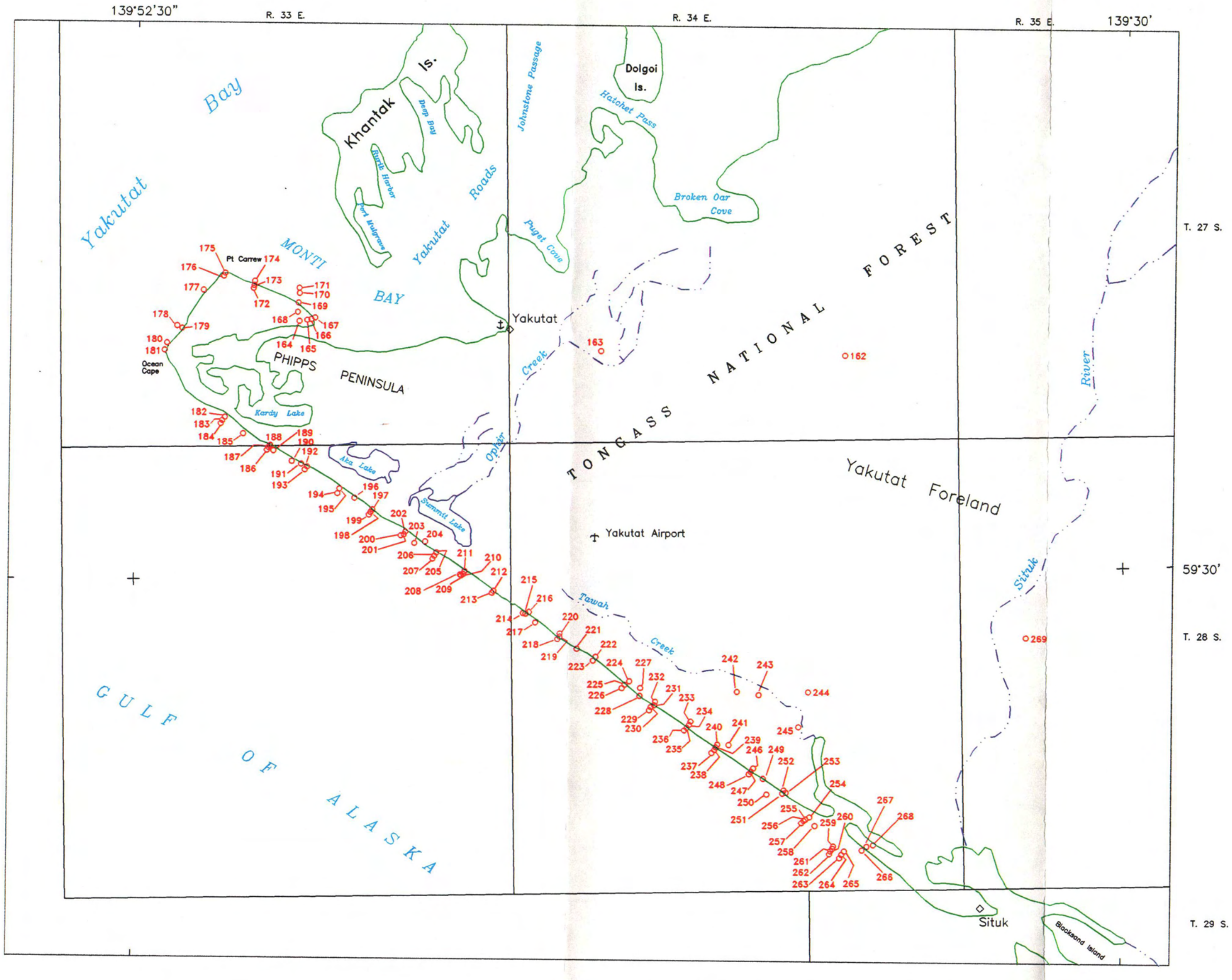
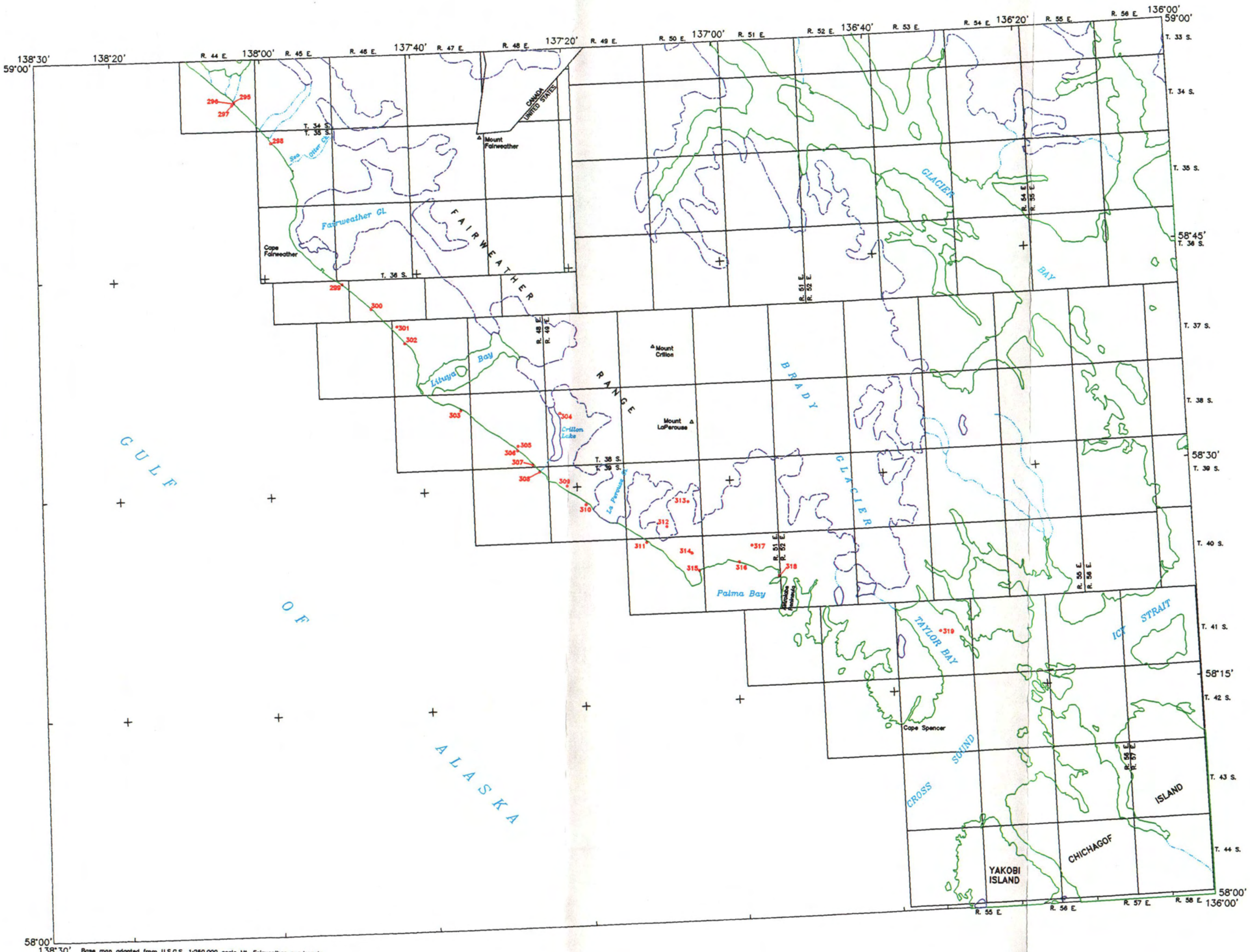


Figure 16. Sample location map of the Yakutat Bay – Situk River area.



Base map adapted from U.S.G.S. 1:250,000 scale Mt. Fairweather quadrangle

Figure 17. – Sample location map of the Cape Fairweather – Cross Sound area.

Figure 18. -- Power auger sampling near Yakutat.

Figure 19. -- Hand auger sampling near Cape Fairweather.

minerals and, therefore, provide only qualitative information on source rocks.

Sample site selection was influenced by deposit type and thickness, water content, grain size (presence or absence of cobbles or boulders), vegetative cover and debris, exposure, and accessibility. Modern beach deposits consisting mostly of sand-size particles were easily sampled with either power or hand augers. The most common impediments to auger sampling were cobbles, boulders, buried driftwood and fallen trees, and water-saturated sand. These obstacles were avoided, to some extent, by moving short lateral distances or, where sand was water-saturated, by moving up the beach face. Where these obstacles prevailed, sample collection was limited to surface material. Channel samples were collected with scoops or shovels from older shoreline deposits exposed in wave-cut terraces at back beach areas. Some exposures were incompletely sampled where they were too high or too steep to sample effectively. Grab samples were collected where no means of sampling subsurface material was available. The one high-grade sample is equivalent to a grab sample collected where natural concentrations of heavy minerals were present at the beach surface.

Largely because of dense vegetative and peat cover, inland areas were more difficult to access and sample than beaches. Access to these areas with a power auger was limited to a few localities crossed by roads or trails. Because the power auger did not readily penetrate the coarse-grained roadbed material of logging roads in the Yakataga area, minimum penetration and recovery were obtained there. Better penetration and recovery were achieved with the power and hand augers on sandy logging trails in the Yakutat area. In 1993, helicopter access provided limited opportunity to sample former strandline deposits in inland areas. River sediment samples were collected along major streams throughout the study area to provide some insight into therovenance of heavy minerals in the shoreline deposits.

In the Yakataga and Yakutat areas, power auger samples were collected at approximately 2 km intervals along the beaches and from higher-elevation terraces in inland areas. Intervals sampled by power auger ranged from 1 to 4.25 m and the maximum depth penetrated was 11 m. On the modern beaches, power auger samples were collected in the intertidal zone, generally closer to the high-tide mark where water-saturated sediment is at a greater depth.

In the Yakataga and Yakutat areas, hand auger samples were collected along transects perpendicular to the coastline spaced 1 km apart. Two to 4 sample sites, spaced 25 to 100 m apart were selected on each transect. Sampled intervals ranged from 0.3 to 2 m. The maximum thickness sampled was 6 m.

In 1993, sampling outside the Cape Yakataga and Yakutat areas was primarily of a reconnaissance nature. Sediment sampling in these areas was done by hand augers with a density of about 1 hole every 5 to 8 km. This sampling strategy was governed by our helicopter support.

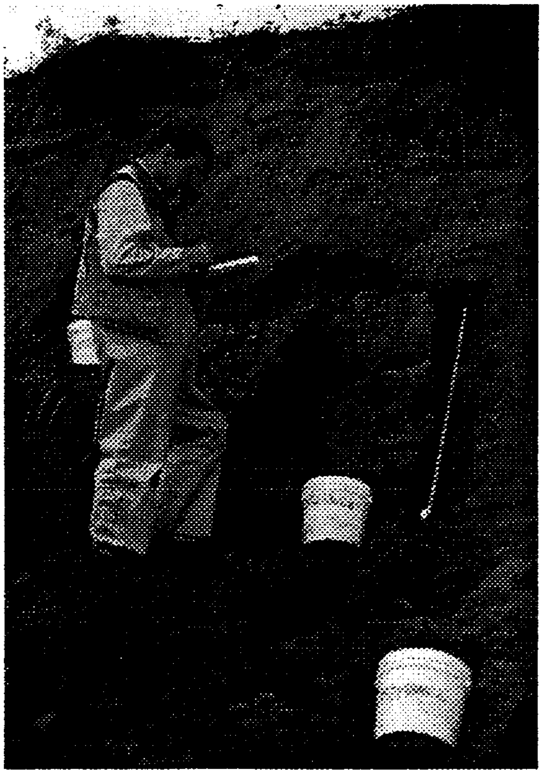


Figure 20. -- Channel sampling at mouth of the Situk River.

Laboratory methods

Sample preparation

Prior to shipping samples to the Salt Lake City, UT, Research Center (SLRC) for processing, attempts were made to screen the samples in the field. Owing to a lack of equipment and facilities, sample screening in the field proved inefficient. Subsequently, the remaining samples were shipped (unsized) to SLRC for processing and heavy-mineral concentration. Weights of all fractions produced during sample processing are listed in Appendix B. Weights of samples that were screened in the field were mathematically reconstructed.

Sample processing at SLRC consisted of four primary stages (fig. 21). These stages consisted of:

(1) following inventory and gross weight measurement, samples were dried, tare determined for containers, and net weights determined

(2) dry samples were split into four fractions with a Jones splitter:
  a. unsized spiral feed split (3/4 fraction)
  b. flotation split (1/8 fraction)
  c. unsized archive split (1/16 to 7/64 fraction)
  d. unsized head split (1/64 to 1/16 fraction)

(3) heavy-mineral concentrates were produced by spiralling

(4) spiral products were dried, weighed, and concentrates were rotary split into two fractions:
  a. mineral characterization split (3/4 to 7/8 fraction)
  b. spiral concentrate assay split (1/8 to 1/4 fraction).

About 100 g were required for chemical analyses of head and spiral concentrate splits. Therefore, the proportions of splits listed above in 2c-d and 4a-b differ among samples, depending on the weights of bulk samples and spiral concentrates.

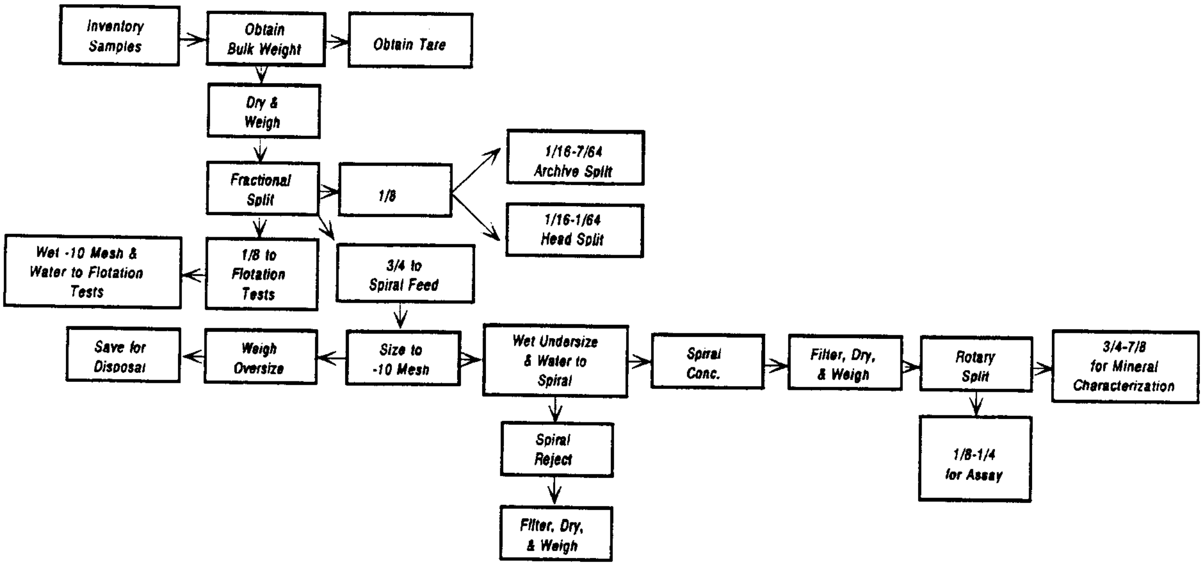


Figure 21. -- Sample processing flowchart. Flotation and sieve tests for precious metals were conducted on selected samples.

Many of the samples from the Yakataga area were processed slightly differently than the remainder of the samples. All the Yakataga power auger samples were wet-screened at 10 mesh (Tyler standard mesh size) prior to splitting fractions for spiral feed, flotation tests, archival, and assay. After processing of the Yakataga samples had begun, it was decided to conduct flotation tests for precious metals. To preserve the natural distribution of precious metals in the head and spiral feed splits, screening was delayed, in all but the Yakataga power auger samples, until the samples had been split. Spiral feed splits were then sized at 10 mesh. A separate split was screened at 20 mesh for those samples subjected to flotation tests for precious metals.

Heavy-mineral preconcentration

Following splitting into the four fractions, heavy minerals were preconcentrated by passing the spiral feed split through a three-turn fiberglass spiral, with a molded rubber lining (fig. 22). Although designed for wear-resistance, the molded rubber lining increases the efficiency of the relatively short path through the three-turn spiral. In contrast to production spirals with a greater number of turns, the three-turn spiral was used in this study to facilitate rapid processing of samples and rapid cleaning between samples. Because of time constraints and the large number of samples to be processed, multiple passes to improve heavy-mineral separation were not made. One problem encountered during sample processing was difficulty in maintaining even wetting of the rubber lining and by overloading of solids. These adverse effects are manifested by unrecovered heavy minerals present in spiral rejects.

Figure 22. -- Three-turn spiral used to preconcentrate heavy minerals.

Two products, a spiral concentrate and a spiral reject, were produced from each sample. To avoid loss of fine gold and platinum-group metals particles during spiralling, wash water was captured along with each product and allowed to sit overnight. The following day, clear water was decanted from the numerous pails used to process each sample, and water used to rinse the products from pails into drying pans was filtered. The filter cake was dried and combined to the corresponding concentrate or reject prior to weighing and further processing.

Magnetic separation and mineral characterization

Spiral concentrates were sent from SLRC to the Albany, OR, Research Center (ALRC) for mineral characterization. Because of the large number of samples collected (224 from Cape Yakataga and 226 from Yakutat in 1992, and 96 from throughout the eastern Gulf of Alaska region in 1993), representative Ti-, Zr-, Au-rich, and low-grade samples were selected from each region of study. Fifty-six samples were selected from the Yakataga area, 55 from the Yakutat area, and 45 from the samples collected throughout the entire region in 1993. Magnetic separation and mineral characterization data are presented in Appendix C.

Selected concentrates were weighed, blended, and split for magnetic separation (fig. 23). Splits from the selected concentrates were screened to remove any coarse (plus 20-mesh) and fine (minus 200-mesh) materials that could impede the flow of grains in the magnetic separator. This over- and under-sized material was characterized separately from the magnetic separation products. Material that adhered to a hand magnet was removed before putting a sample

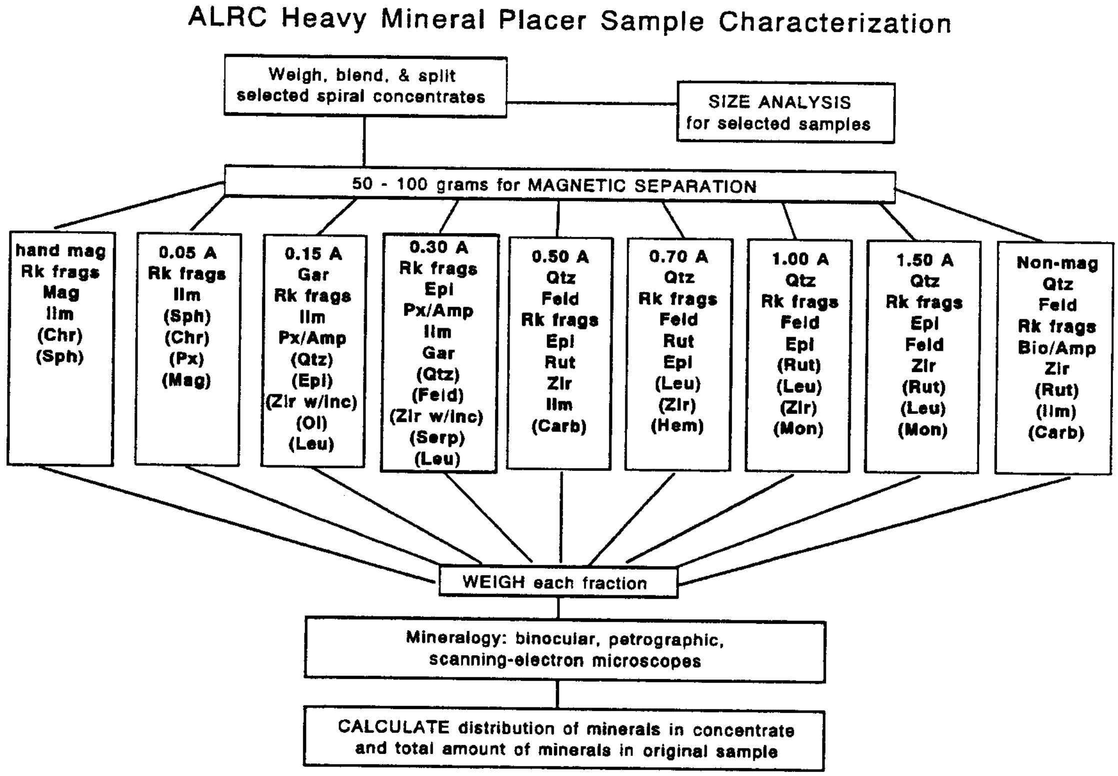


Figure 23. -- Magnetic separation and mineral characterization flowchart. Minerals of minor occurrence are shown in parentheses.

through the magnetic separator. A Frantz Barrier Magnetic Separator[11] was used to incrementally separate minerals in the remaining sample into nine fractions according to magnetic susceptibility. Progressively higher amperages were used in subsequent passes through the apparatus to separate less magnetic minerals. A low-amperage pass to remove any remaining ferromagnetic grains yielded the first magnetic fraction (0.05 A). The 0.15 ampere fraction contains mostly ilmenite and Fe-rich garnet. The 0.30 ampere fraction contains many ferromagnesian silicate minerals and altered ilmenite. The 0.50, 0.70, 1.00, and 1.50 ampere fractions contain ferromagnesian silicates and other moderate- to low-susceptibility minerals. The nonmagnetic fraction contains zircon and rutile if present, and most of the quartz, feldspar, or carbonate minerals in the concentrate.

The weights of all fractions of magnetically separated samples were entered into a computer spreadsheet and charted to display magnetic susceptibility - abundance trends. Samples collected in 1992 from the Cape Yakataga and Yakutat areas were grouped by similar mass distributions as defined by histogram shapes (histograms not shown; 7 Cape Yakataga and 9 Yakutat groups were distinguished). One to four samples were selected as representatives from each group. No such groupings were made of the 1993 samples. Each magnetic fraction of these representative samples was studied in detail, by using low-magnification stereo, petrographic-transmitted light, and scanning-electron microscopes.

Polished-surface grain mounts were made of the fractions from the 1992 Yakataga and Yakutat samples that contained abundant opaque minerals. Mounts of this type were made for the hand magnetic, 0.05 ampere, 0.15 ampere for Yakataga and Yakutat concentrates, plus the minus 200-mesh size fractions and the 0.30 ampere magnetic fractions for Yakutat concentrates. Polished surface mounts were not made of the 1993 samples, because of the large number of samples and time constraints. Polished mounts were not made of the minus 200-mesh material or the 0.30 ampere fraction from the Yakataga concentrates. Yakataga samples tended to have very little fine-grained material and these fines contained few opaque minerals. The 0.30 ampere fractions for Yakataga samples also had very few opaque minerals. Yakutat concentrates, in contrast, contained up to 32 percent fines that are dominated by opaque minerals. Yakutat samples also contained abundant opaque minerals in the 0.30 ampere fraction. It was therefore useful to mount these fractions of the Yakutat samples. Grains were mounted in epoxy, polished, and examined with an Amray 1000 scanning-electron microscope (SEM). Using backscattered electron images, which indicate atomic number by differing brightness (brightness is proportional to atomic number), ilmenite (Ti-Fe) and magnetite (Fe) were easily distinguished from other opaque minerals, such as spinel (Mg-Al). The SEM was also used to measure Fe:Ti ratios in ilmenite. A Kevex energy dispersive X-ray (EDX) analyzer attached to the SEM measures the energy signatures (KeV) of the electrons emitted by the sample. A computer program was used to process the escape peaks, remove the background, and deconvolute the curves to quantify the abundance of each element.

Magnetic fractions of samples that were not mounted in epoxy were examined in reflected light with a low-magnification stereo microscope (10-70X) and a petrographic microscope (25-400X). Mineral concentrations were determined by visually estimating the percent of the minerals present in the sample.

---

[11] Reference to specific products does not imply endorsement by the U. S. Bureau of Mines.

The percentages of the various minerals in a magnetic fraction were entered into a computer spreadsheet to calculate the total weight of the minerals in each fraction (Appendix C). Because of variations in a mineral's chemical composition and the presence of inclusions and complex intergrowths, an individual mineral may occur in more than one magnetic fraction (fig. 23). The calculated weights of a mineral in the various magnetic fractions were then added together and divided by the total weight of the characterized concentrate split (combined weights of all magnetic fractions, the plus 20-, and minus 200-mesh fractions) to yield the total percentage of the mineral in the spiral concentrate. The percentage of a mineral in the concentrate was multiplied by the weight of the concentrate and divided by the reconstructed weight of the sample (spiral concentrate + tails + gravel) to give the total abundance of the mineral in the beach sand. These values are almost certainly underestimates of the true mineral abundances, because the spiral was not entirely effective at recovering the heavy minerals.

Analytical procedures

Chemical analyses of head sample and spiral concentrate splits

Head and spiral concentrate splits were assayed by a commercial laboratory for titanium, zirconium, and gold (Appendix A). These data were used primarily to select samples for heavy-mineral characterization and flotation studies.

Titanium and zirconium were analyzed by X-ray fluorescence procedures following borate fusion. Gold was analyzed by atomic absorption spectroscopy following fire assay preconcentration.

Gold was detected in 61 head sample splits and 104 spiral concentrate splits. Because no consistent relation exists between gold-bearing head and concentrate splits (Appendix A), assays on 30-g splits are not considered reliable means of measuring gold content in the Gulf of Alaska beach sands. To further investigate gold and platinum-group metal distribution, additional tests were performed on larger samples.

Chemical analyses of magnetic fractions

Magnetic fractions of selected characterized samples were analyzed for the elements listed in Appendix D. As indicated in the appendix, analytical procedures used include X-ray fluorescence (XRF), neutron activation analysis (NAA), fire assay - inductively coupled plasma (FAA-ICP), and atomic absorption spectroscopy (AAS).

Precious metal studies

Gravity concentration with spirals, as described in the section on "Heavy-mineral preconcentration", incompletely recovered gold in the samples (Appendix A). For this reason, flotation and sieve tests were conducted on selected samples to assess the applicability of precious metal flotation as a commercial recovery method and to compare results of the two procedures to head and spiral concentrate assay data.

A goal of the flotation and sieve tests is to concentrate and recover all the gold from splits that are larger than those used in the conventional assays and to assay all the gold in the resultant flotation concentrates and sieve fractions. Splits used for the two tests were the flotation (1/8) and archive (1/16-7/64) splits (fig. 21); following dry-screening at 20 mesh, these splits ranged in size from about 160 g to greater than 2,000 g.

Directly-coupled plasma analysis of fire assay preconcentrated beads was used to determine gold, platinum, and palladium content in the flotation concentrates and tails. Gravimetric fire assay procedures were used to determine the concentrations of these elements in the sieve test fractions. Lower detection limits varied in both cases as a function of sample size.

Flotation tests were conducted with tap water in two Denver laboratory flotation cells having different volumes. In the first series of batch tests on seven Yakataga samples, equal amounts of potassium amyl xanthate (KAX) and Aerofloat 208 (a dithiophosphate) were added as collectors at 0.025 kg/t each and conditioned for 3 minutes at natural pH. Before flotation began, a frother consisting of methyl isobutyl carbinol (MIBC) and Aerofroth 65, in a 3:1 mixture, was added one drop at a time, as needed, and conditioned for 15 seconds. Flotation proceeded with no pH adjustment, until the froth was exhausted, usually in five to seven minutes. Assays from the first series of tests were completed before the samples used in the second series were selected. Because low gold recoveries were observed in the first series of tests (table 3) a different collector was chosen for the second series. The Aerofloat 208 used in the first series was replaced with a monothiophosphate salt (Cyanamid S-6697); the same ratio and dosage were used as with Aerofloat 208.

In the second series of tests, the feed was conditioned with 0.025 kg/t each, of the collectors KAX and S-6697, at 50 percent solids for three minutes at natural pH. The same frother was used as before. Flotation was targeted to run at a nominal 25 percent solids. In the second series of tests, the froth was collected for a minimum of seven minutes.

Batch testing of samples with different volumes precluded maintenance of constant test conditions. Conditions that varied throughout the flotation tests included pulp density, impeller speed, cell size, and frother dosage. In order to bring the slurry level near the top of the cell, so that froth could be discharged and collected, different amounts of dilution water had to be added for the various samples. This resulted in different pulp densities among the samples during processing. Also, to maintain froth quality, energy imparted to the cell by the impeller was varied by altering the impeller speed. As froth was removed from the system, more water was required to maintain the desired level in the cell, further varying the pulp density. During the flotation tests, pulp densities ranged from about 17 to 39 percent solids and impeller speeds ranged from 1,050 to 2,300 revolutions per minute.

The sieve test procedures consisted of screening the selected archive splits at 20 and 150 mesh, followed by multiple fire assays of the minus 150-mesh, and a single fire assay of the plus 150-mesh material (table 4). The plus 20-mesh fraction was not assayed. Results of the minus 150-mesh assays were averaged and weighted totals for gold, platinum, and palladium in the minus 20-mesh sample material were calculated.

Seven hand auger samples from the Yakataga area (samples prefixed by HA92YK in tables 3-5) were selected for the initial series of flotation and sieve tests. Flotation concentrates

Table 3. -- Gold, platinum, and palladium in flotation test products

Map number	Sample	Wt. (g)	Wt. pct	Assays (g/t)			Distribution (pct)[1]		
				Au	Pt	Pd	Au	Pt	Pd
2	RS93GA 75 Conc.	14.6	5.7	0.073	0.014	0.002	33.1	16.9	5.7
	Tails	240.4	94.3	0.009	<0.004	0.002	66.9	83.1	94.3
	Feed (calc.)	255.1	100.0	0.013	<0.005	0.002	100.0	100.0	100.0
7	HA93GA 70 Conc.	12.6	0.9	6.505	0.031	<0.001	97.2	6.3	0.9
	Tails	1389.3	99.1	0.002	<0.004	<0.001	2.8	93.7	99.1
	Feed (calc.)	1402.0	100.0	0.060	<0.005	<0.001	100.0	100.0	100.0
21	HA92YK 106 Conc.	2.0	0.2	15.860	0.085	0.056	29.6	0.3	0.2
	Tails	890.1	99.8	0.085	<0.056	<0.056	70.4	99.7	99.8
	Feed (calc.)	892.1	100.0	0.113	<0.056	<0.056	100.0	100.0	100.0
28	HA92YK 111 Conc.	9.1	0.4	7.253	0.008	0.017	9.6	0.1	0.1
	Tails	2201.9	99.6	0.282	<0.056	<0.056	90.4	99.9	99.9
	Feed (calc.)	2211.0	100.0	0.310	<0.056	<0.056	100.0	100.0	100.0
46	HA92YK 124 Conc.	4.0	0.2	0.198	0.056	0.037	0.3	0.2	0.1
	Tails	1923.9	99.8	0.141	<0.056	<0.056	99.7	99.8	99.9
	Feed (calc.)	1927.9	100.0	0.141	<0.056	<0.056	100.0	100.0	100.0
76	HA92YK 147 Conc.	2.8	1.0	14.787	<0.003	0.042	63.7	0.1	0.7
	Tails	278.8	99.0	0.085	<0.056	<0.056	36.3	99.9	99.3
	Feed (calc.)	281.6	100.0	0.226	<0.056	<0.056	100.0	100.0	100.0
96	HA92YK 159 Conc.	2.3	0.3	3.499	<0.003	0.102	14.5	0.0	0.5
	Tails	838.6	99.7	0.056	<0.056	<0.056	85.5	100.0	99.5
	Feed (calc.)	840.9	100.0	0.056	<0.056	<0.056	100.0	100.0	100.0
153	HA92YK 185 Conc.	3.9	0.8	17.948	0.023	0.042	84.3	0.3	0.6
	Tails	461.3	99.2	<0.028	<0.056	<0.056	15.7	99.7	99.4
	Feed (calc.)	465.2	100.0	<0.169	<0.056	<0.056	100.0	100.0	100.0
153	HA92YK 186 Conc.	14.2	0.8	0.113	0.006	0.011	0.5	0.1	0.2
	Tails	1743.2	99.2	0.169	<0.056	<0.056	99.5	99.9	99.8
	Feed (calc.)	1757.4	100.0	0.169	<0.056	<0.056	100.0	100.0	100.0
184	HA92YA 826 Conc.	1.9	0.3	0.866	<0.004	<0.001	77.0	0.3	0.3
	Tails	591.2	99.7	<0.001	<0.004	<0.001	23.0	99.7	99.7
	Feed (calc.)	593.2	100.0	<0.004	<0.004	<0.001	100.0	100.0	100.0
207	HA92YA 808 Conc.	2.8	0.6	0.621	<0.004	<0.001	81.5	0.6	0.6
	Tails	472.1	99.4	<0.001	<0.004	<0.001	18.5	99.4	99.4
	Feed (calc.)	474.9	100.0	<0.005	<0.004	<0.001	100.0	100.0	100.0
267	CH92YA 866 Conc.	0.9	0.1	1979.36	<0.004	10.10	80.4	0.1	86.0
	Tails	1827.6	99.9	0.248	<0.004	<0.001	19.6	99.9	14.0
	Feed (calc.)	1828.5	100.0	1.266	<0.004	<0.006	100.0	100.0	100.0
295	HA93GA 34 Conc.	3.6	0.3	11.316	<0.004	<0.001	97.5	0.3	0.3
	Tails	1268.3	99.7	0.001	<0.004	<0.001	2.5	99.7	99.7
	Feed (calc.)	1272.0	100.0	0.033	<0.004	<0.001	100.0	100.0	100.0
303	HA93GA 23.1 Conc.	2.2	0.2	1.844	<0.004	<0.001	7.6	0.2	0.2
	Tails	1388.9	99.8	0.036	<0.004	<0.001	92.4	99.8	99.8
	Feed (calc.)	1391.2	100.0	0.039	<0.004	<0.001	100.0	100.0	100.0

[1] Distributions calculated on the basis of detection limit values are maximum possible values and may be poor approximations.

Table 4. -- Gold in sieve test products

Map number	Sample	Weight (g) minus 150	Weight (g) plus 150	Minus 150 Au (g/t)	Plus 150 Au (g/t)	Total Au g/t
2	RS93GA 75	163.2	13.74	<0.028	<0.282	<0.028
7	HA93GA 70	256.3	46.72	<0.028	<0.282	<0.028
21	HA92YK 106	681.2	18.71	0.310	2.540	0.367
28	HA92YK 111	1928.7	18.94	0.085	5.080	0.141
46	HA92YK 124	1722.8	22.68	<0.028	0.564	<0.028
76	HA92YK 147	908.7	26.38	<0.028	0.564	<0.028
96	HA92YK 159	1788.9	23.17	<0.028	<0.282	<0.028
153	HA92YK 185	688.7	10.53	0.113	<0.282	0.113
153	HA92YK 186	1318.8	29.55	<0.028	2.258	0.056
184	HA92YA 826	329.6	19.39	0.056	<0.282	0.056
207	HA92YA 808	180.2	4.9	<0.028	<0.282	<0.028
295	HA93GA 34	310	21.03	<0.028	<0.282	<0.028
303	HA93GA 23.1	332	9.68	0.028	<0.282	<0.028

All fractions contained less than 0.056 g/t Pt and Pd.

Table 5. -- Comparison of gold in head splits, spiral concentrate splits, flotation test feed, and sieve test feed

Map number	Sample	Au, Head split (g/t)	Spiral conc. (g/t)	Flotation feed (g/t)
2	RS93GA 75	<0.028	1.721	0.013
7	HA93GA 70	0.028	0.282	0.060
21	HA92YK 106	0.677	0.903	0.113
28	HA92YK 111	0.480	0.423	0.310
46	HA92YK 124	<0.028	0.790	0.141
76	HA92YK 147	<0.028	12.219	0.226
96	HA92YK 159	<0.028	0.790	0.056
153	HA92YK 185	<0.028	1.552	<0.169
153	HA92YK 186	<0.028	0.452	0.169
184	HA92YA 826	2.145	<0.028	<0.004
207	HA92YA 808	0.367	<0.028	<0.005
267	CH92YA 866	1.298	0.113	1.266
295	HA93GA 34	<0.028	0.339	0.033
303	HA93GA 23.1	0.056	0.649	0.039

All fractions contained less than 0.056 g/t Pt and Pd.

ND - Not determined (sieve tests not performed on CH92YA 866).

from the Yakataga samples contained from 0.113 g/t Au to 17.9 g/t Au. Erratic recoveries, ranging from 0.3 to 84.3 percent, were observed. Trace platinum (0.006-0.085 g/t) and palladium (0.011-0.102 g/t) were also detected in the flotation concentrates. Scanning-electron microscopy showed that ferroan platinum, sperrylite ($PtAs_2$), and merteite [$(Pd,Cu)_{5+x}(Sb,As)_{2-x}$] are present in heavy-mineral concentrates from Cape Yakataga.[12] Sieve tests showed that gold is nonuniformly distributed in the minus 150-mesh and plus 150-mesh fractions. Calculated gold grades for the sieve test feed ranged from <0.028 g/t to 0.367 g/t (table 4). No platinum or palladium were detected in the Yakataga sieve test fractions.

Subsequently, seven samples from the Yakutat area (samples prefixed by HA92YA and CH92YA in tables 3-5) and further east along the Gulf of Alaska (samples prefixed by RS93GA and HA93GA in tables 3-5) were selected for additional study. In the second series of flotation tests, gold recoveries were markedly improved, with tests for all but two concentrates showing gold recoveries greater than 77 percent and a maximum of 97.2 percent (table 3). Gold grades in the flotation concentrates ranged from 0.073 to 1,980 g/t. Trace platinum (0.014-0.031g/t) and palladium (0.002-10.10 g/t) were detected in flotation concentrates. As a result of sieve tests on the second series of samples, gold was detected in two minus 150-mesh fractions and in none of the plus 150-mesh fractions. Also, no platinum or palladium were detected in the sieve fractions. Note that sieve tests were not performed on sample CH92YA 866 (tables 4-5).

In the flotation tests, the high variability in gold recovery may be caused by particle size effects and subtle variations in gold particle surface chemistry caused by the presence of alloying elements, inclusions, tarnish, and mineral coatings.

Caution must be used in interpreting some of the results in table 3. Many of the samples contain platinum and palladium concentrations lower than the detection limits. This phenomenon also applies to some of the gold assays. In these cases, the detection limits have been used in calculating elemental distributions, and therefore, the calculated recoveries (distributions) may be markedly erroneous. Notwithstanding these factors, it is apparent that gold in the tested material can be concentrated by flotation, in some cases with good concentrate grades and recoveries. It is also important to remember that the small quantities of sample available precluded any optimization studies. Flotation may be useful in a commercial recovery plant as a primary recovery technique or, following primary gravity concentration, as a cleaning or scavenging step.

Because the flotation test conditions varied, it is suggested that the abundance of gold in concentrates from the second sample series reflects the changes made in flotation test conditions, not the relative abundance of gold at Yakataga compared to the other sites.

Gold values for head split assays and head feed (calculated) should be nearly equal to demonstrate reliable results. At best, a crude correlation is demonstrated by the combination of tests (table 5). Spiral concentrate assays are provided to show that there is a tangible benefit to preconcentrating the material prior to flotation. Because the spiral concentrates from samples HA92YA 808 and HA92YA 826 assay much lower in gold than the corresponding head and calculated feed assays, gold loss during concentration is a persistent risk. Note that the head splits from these two samples and from CH92YA 866 contained more gold than the corresponding spiral concentrate splits. It is suspected that the observed poor to sporadic

---

[12] Sample provided by Mr. Carl Glanville, Anchor Point, Alaska

correlation between gold content in the head and spiral concentrate splits is the result of the often-observed 'particle-sparsity effect' or 'nugget effect', which are compounded by small assay split size compared to large bulk sample or concentrate size.

RESULTS AND DISCUSSION

Mineralogy

The heavy-mineral concentrates of the eastern Gulf of Alaska region contain a suite of minerals that reflects the diverse geology of the region. Magnetite, ilmenite, and hematite are the most common opaque minerals observed. Rare flakes of gold are also present. Nonopaque minerals include a host of Fe-Mg silicates, abundant garnet, and small amounts (less than 1 pct each) zircon, rutile[13], sphene, apatite, monazite, and allanite. This report focuses on the economically valuable minerals in this suite (ilmenite, rutile, zircon, monazite, and gold) and does not attempt to identify or describe exceedingly rare mineral species that are not known to be valuable.

The results of the mineralogic determinations of reconnaissance samples collected in the Cape Yakataga, Yakutat, and Mt. Fairweather areas are given in Appendix C. Cumulative statistics are given for each area on the respective table in the appendix. Mineralogic data are given as percentages of the bulk sediment sample calculated on the basis of heavy minerals recovered by the sample processing scheme described earlier. Insofar as an unknown amount of heavy minerals were rejected by the spiral concentrating mechanism, the data in Appendix C are underestimates of the total heavy-mineral content of the bulk sediment samples. An indication of the effectiveness of the processing scheme is shown by comparison of the respective analytical results for head feed and concentrate splits (Appendix A). These data show that although spiral concentration generally reduced the volume to one tenth of the head feed, zirconium and titanium values in concentrates increased only about two-fold with respect to head feed.

A comparison of the total economic heavy-mineral (ilmenite + zircon + rutile) content of samples from the three areas reveals that the Yakutat area contains a heavy-mineral suite more enriched in economic heavy minerals. Samples from this area contain an average of 3.39 percent economic minerals in a range from 0.21 to 14.77 percent, the maximum for the three areas. Samples from the Mt. Fairweather area contain the next highest average (2.43 pct), in a range of 0.02 to 14.26 percent. Samples from the Cape Yakataga area have the lowest overall heavy-mineral content (0.02 to 2.92 pct, average 0.57 pct). Variability, as expressed by the standard deviation about the average (Appendix C), is high in all three areas. Several sample sites contain heavy-mineral contents suggestive of commercial potential for titanium minerals. This potential, however, must be evaluated in terms of: (1) the quantity of valuable heavy minerals rejected by

---

[13] The term "rutile" is used here to include all >90 percent TiO_2 phases (brookite, anatase, rutile), and was not confirmed through X-ray diffraction or other identification techniques.

the spiral, (2) the vertical continuity of grades and mineral compositions, and (3) the "quality" of the ilmenite (TiO_2 and trace element contents).

Opaque oxide minerals, mostly magnetite and ilmenite, are more abundant in the Yakutat samples than in Cape Yakataga samples. Magnetite concentrations are lowest in the Cape Yakataga area and highest in the Yakutat area. Ilmenite, the most abundant heavy mineral of economic importance, occurs in largest concentrations in the Yakutat area and in smallest concentrations in the Yakataga area. Samples from the Yakataga area contain an average of 0.49 percent ilmenite in a range from 0.02 to 2.31 percent. Samples from the Yakutat area contain an average of 3.23 percent ilmenite in a range from 0.21 to 14.27 percent. Variability in ilmenite content is very high in samples from the Yakutat and Mt. Fairweather areas. Samples from the Mt. Fairweather area contain an average of 2.43 percent ilmenite in a range from 0.02 to 14.25 percent. Throughout the study area, titanomagnetite (<20 pct TiO_2) occurs as discrete grains, some with ilmenite, sphene, or apatite inclusions (fig. 24a). Ilmenite shows a variety of complex intergrowths and exsolution textures. In some grains, an ilmenite phase has exsolved from magnetite, clearly suggesting a magmatic origin. Blade-like intergrowths of ilmenite and hematite were observed in a few samples. In many grains, stoichiometric ilmenite (approximately equal portions of iron and titanium) has exsolved from iron-rich ilmenite (titanomagnetite), with about 80 percent iron and 20 percent titanium (fig. 24b). Ilmenite is commonly intergrown with or altered to sphene in intricate patterns (figs. 24c-d) or along grain boundaries, internal fractures, and lamellae of compositional variation. Ilmenite and magnetite, ilmenite and sphene, and lamellae of two distinct ilmenite phases are also commonly intergrown in octahedral patterns (fig. 24e).

Gold at Cape Yakataga tends to be slightly finer-grained than the average mineral grain. Because gold is very soft and malleable, it is quickly beaten into flat disks in the high energy environment of the beach (figs. 24f-g). As the grains are moved by waves and collide with other sand grains, the edges become folded or curled and beaten back into the center part of the disk. This shape has been noted in other gold placers around the world (for example: Minter and others, 1993; Giusti, 1986; Yeend, 1974). This flattened shape causes the gold to be more susceptible to floating with the surface tension of water, making it difficult to recover. Standard gravity concentration methods used in this study were only partially effective at recovering the gold. Recovery by flotation and sieving, discussed above, also proved difficult.

Ferromagnesian silicates including pyroxene and amphibole are present as discrete grains and as fine euhedral inclusions in magnetite and ilmenite (fig. 24h-i). In other cases, oxide mineral phases such as magnetite and spinel form vermicular growths within the silicate minerals (fig. 24j). Spectral analyses indicate that hornblende, actinolite-tremolite, augite, pigeonite, and hedenbergite compositions are present among the ferromagnesian silicates in the concentrates.

Garnet is more abundant in the Yakataga area than in the Yakutat area. There is a good correlation between the abundance of garnet and the economic heavy minerals (ilmenite + zircon + rutile) for the Cape Yakataga and Yakutat areas, but the relation between these two is not so clear in the Mt. Fairweather area (fig. 25). For Cape Yakataga and Yakutat, garnet may be a good indicator of commercially important heavy minerals in the sediments. Garnet grains range from pink to root beer brown in color, are euhedral with well-preserved crystal faces, and tend to

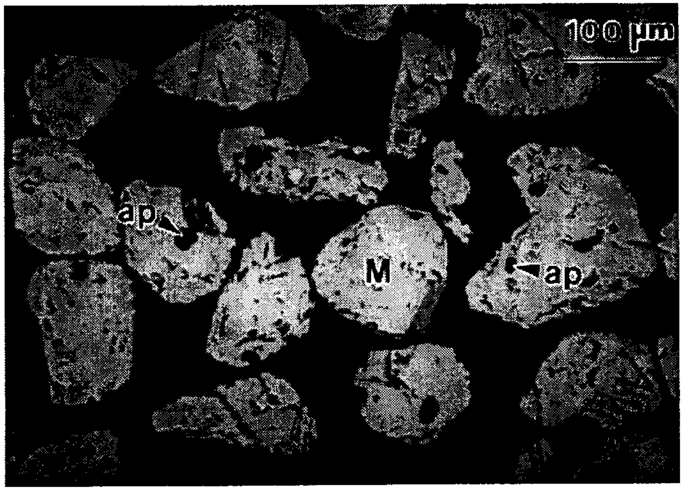


Figure 24a. -- SEM photomicrograph of titanomagnetite grains (M) with apatite inclusions (ap). Sample from magnetic fraction of Yakutat beach sands.

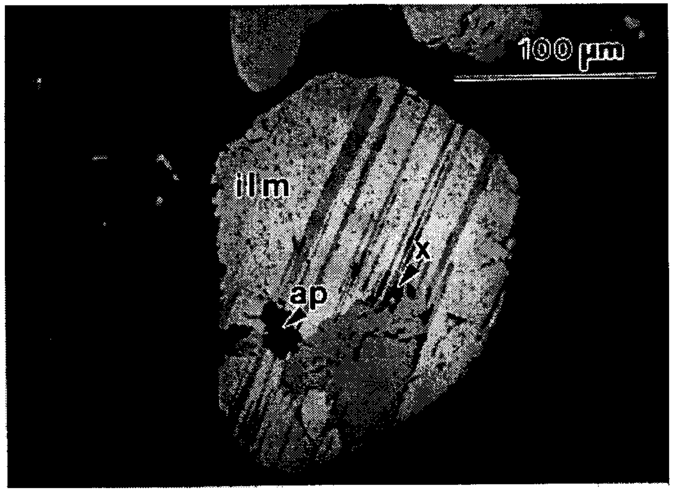


Figure 24b. -- Exolved ilmenite (ilm) grain with pyroxene or amphibole (x) and apatite (ap) inclusions. Sample from Cape Yakataga beach.

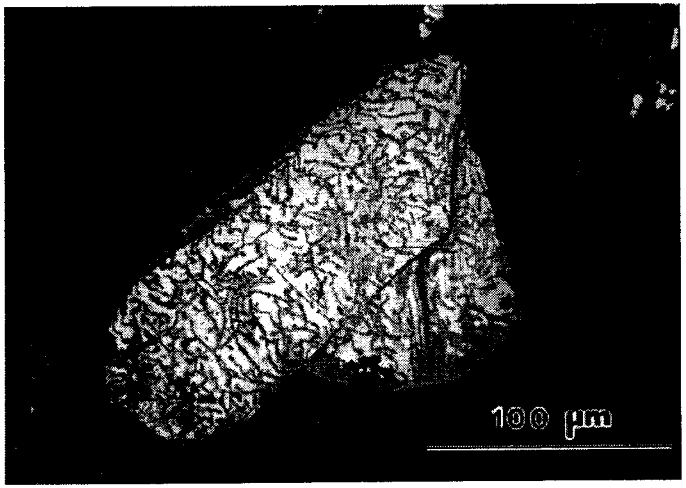


Figure 24c. -- Sphene-altered ilmenite grain. Note that sphene (spn) rims ilmenite grain (ilm) and branches out from fractures. Sample from Cape Yakataga beach.

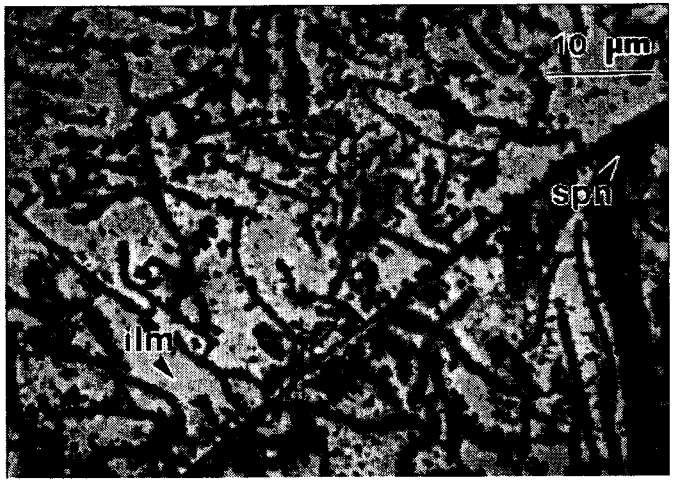


Figure 24d. -- Closeup of fig. 24c.

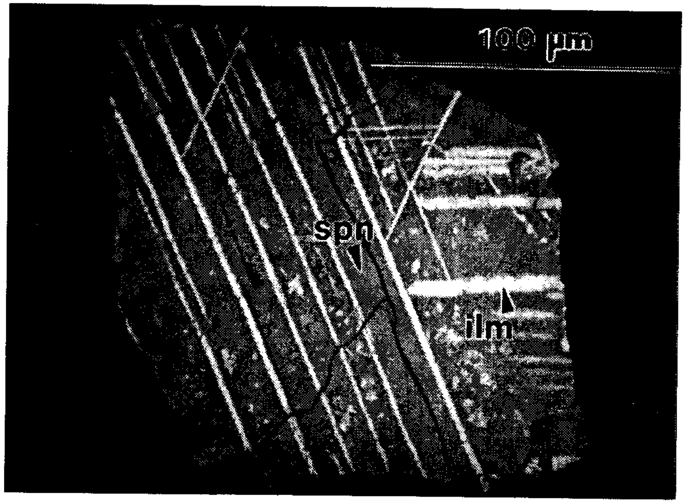


Figure 24e. -- Sphene grain (spn) with relict ilmenite (ilm) lamellae in an octahedral arrangement suggesting the earlier presence of magnetite.

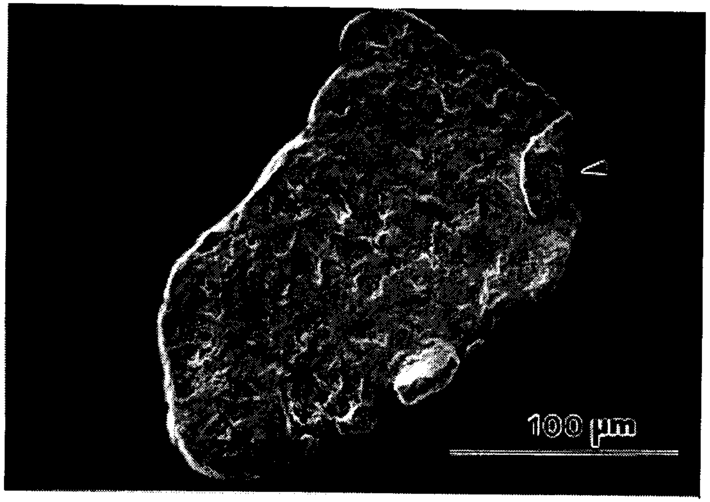


Figure 24f. -- Typical flattened gold grain from Cape Yakataga beach sands. Note folded edges on grain.

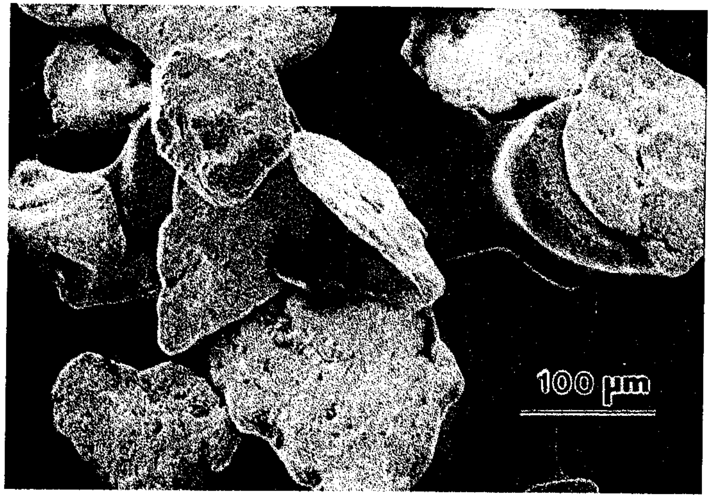


Figure 24g. -- Unusually well-preserved folded gold grains from Cape Yakataga beach sands.

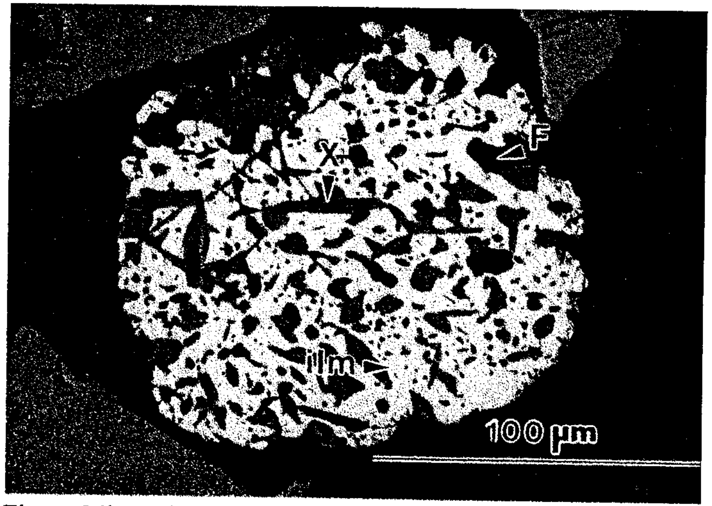


Figure 24h. -- Ilmenite grain (ilm) with feldspar (F), amphibole, or pyroxene inclusions (x). Sample from Cape Yakataga.

Figure 24i. -- Closeup of figure 24h.

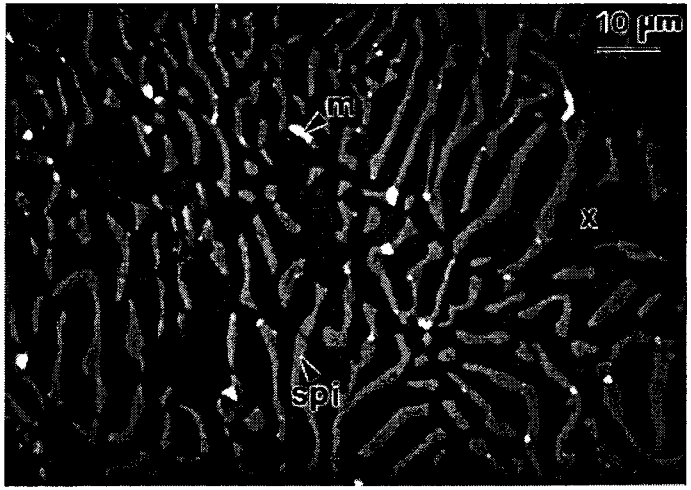


Figure 24j. -- Pyroxene (x), probably hedenbergite, with myrmekitic exsolution of spinel (spi) and magnetite (m). Sample from Cape Yakataga.

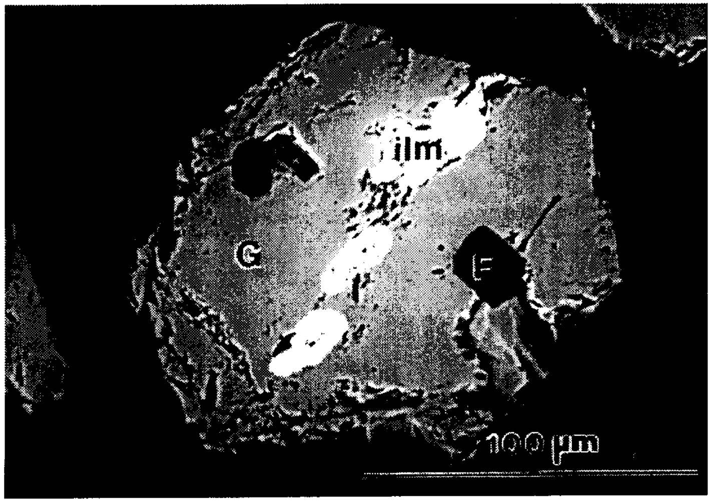


Figure 24k. -- Garnet (G) with plagioclase feldspar (F) and ilmenite (ilm) inclusions. Sample from Cape Yakataga.

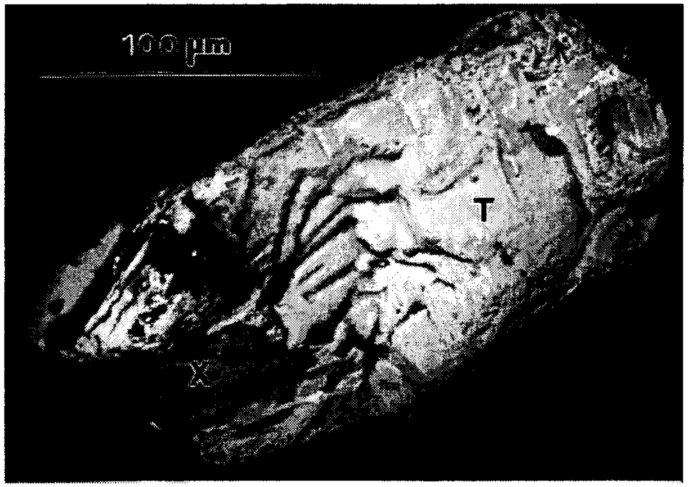


Figure 24l. -- TiO_2 grain (T), possibly rutile, with apatite (ap) inclusions. Sample from Yakutat beach sands.

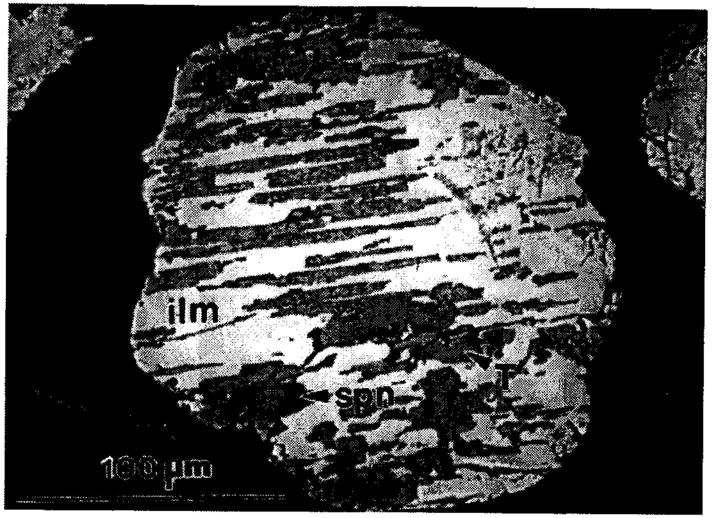


Figure 24m. -- Altered ilmenite grain from Yakutat area. TiO_2 phase (T), probably anatase, is surrounded by sphene (spn) within the ilmenite (ilm).

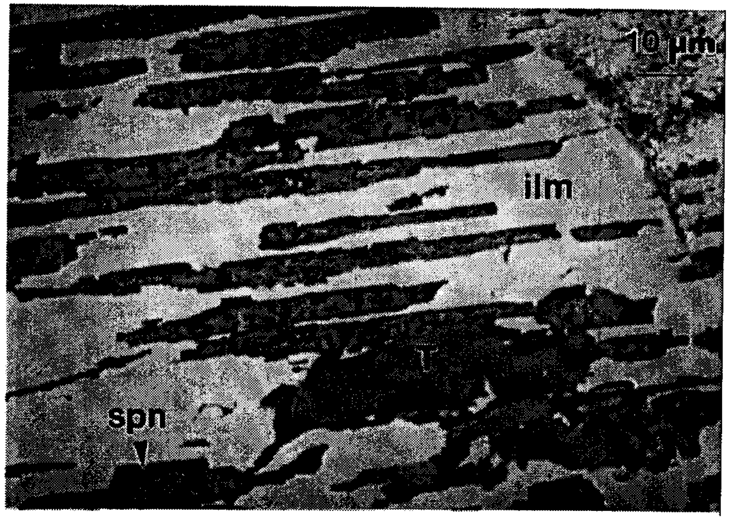


Figure 24n. -- Closeup of figure 24m.

Figure 24o. -- Zircon crystal from the Yakutat area.

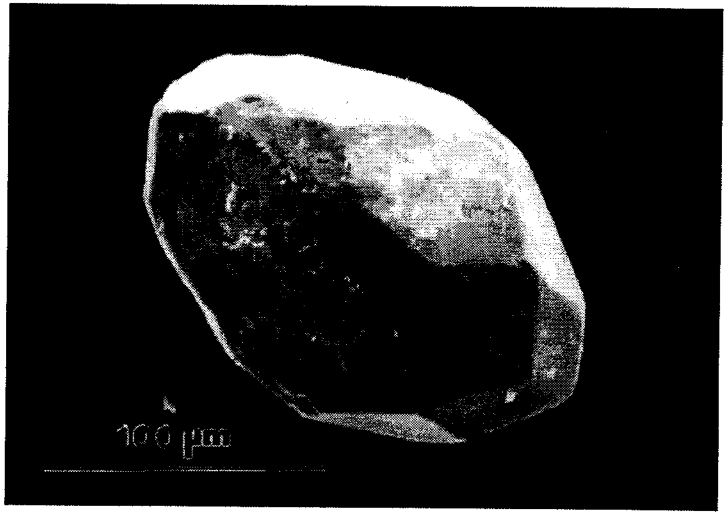


Figure 24p. -- Zircon crystal from the Cape Yakataga area.

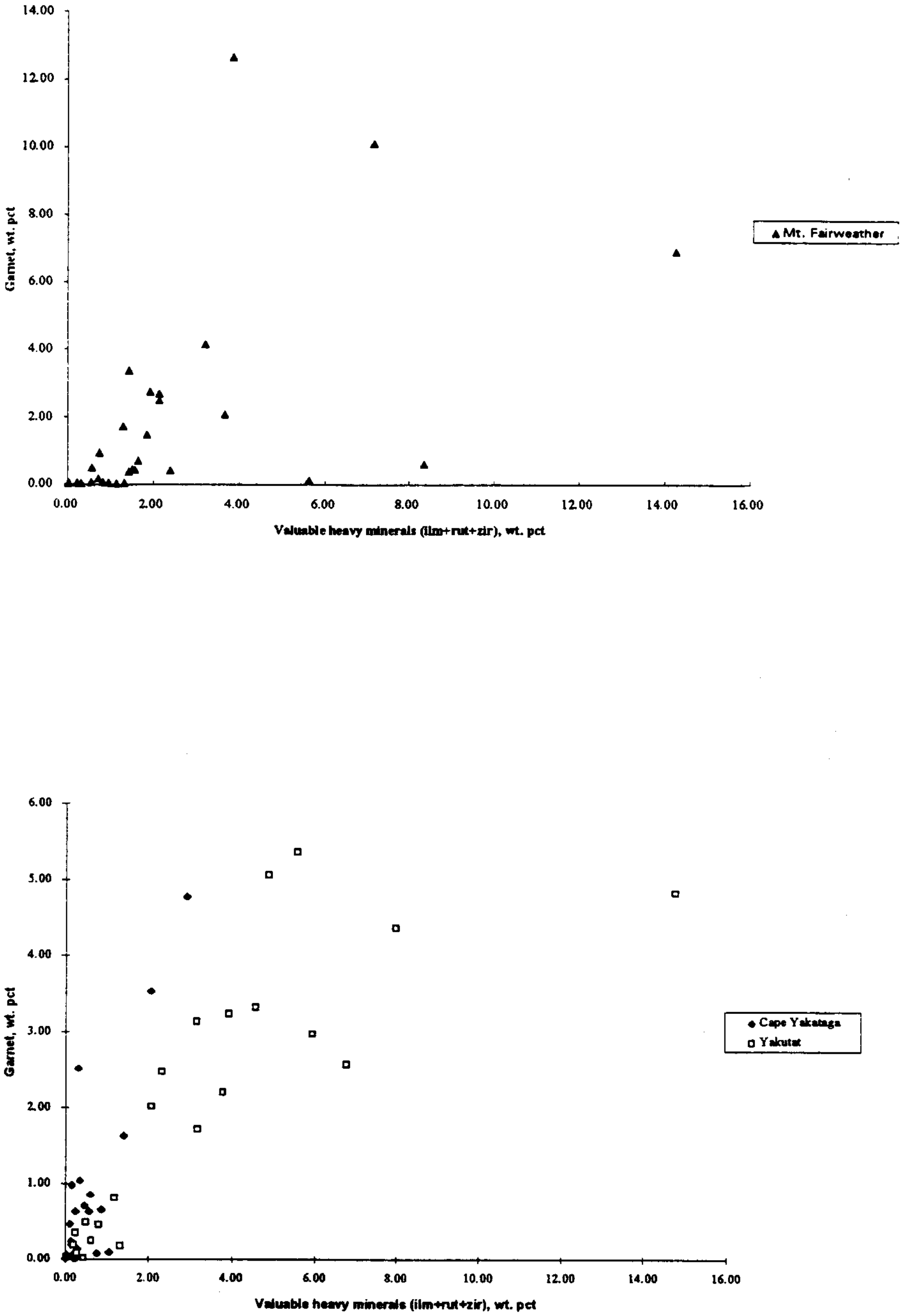


Figure 25. – Graphs of garnet vs. valuable heavy minerals in samples from Cape Yakataga and Yakutat (lower) and Mt. Fairweather areas (upper).

be smaller in size than rock fragments and lighter minerals. Ilmenite, plagioclase, and other minerals (including zircon, magnetite, amphibole, and pyroxene) are present as inclusions in the garnet (fig. 24k). Spectral analyses indicate the garnet is predominantly almandine, with about 70 percent iron and aluminum, and minor magnesium, manganese, and calcium. Because garnet is a relatively low-value heavy mineral used largely as an abrasive, it was not considered a valuable mineral in this study. Given increased demand for existing uses and (or) development of new uses such as water filtration media, the expansive garnet resources in the study area may become more valuable in the future.

Rutile makes up a small portion of the bulk samples in this study; the average content is 0.44 percent in the Yakutat area, 0.05 percent in the Cape Yakataga area, and 0.01 percent in the Mt. Fairweather area. Rutile occurs as discrete grains, commonly with inclusions of sphene or other minerals (fig. 24l). Both sphene and rutile are common alteration products of ilmenite (figs. 24m-n). Sphene appears to be an intermediate phase in the alteration of ilmenite to rutile. Most leucoxene grains are made up of fine intergrowths of rutile and other minerals, including sphene and amphiboles. Very fine-grained TiO_2 crystals within altered ilmenite are provisionally identified as rutile, but may actually be anatase. Much larger "rutile" grains with red color and adamantine luster may be brookite or pseudo-brookite.

Zircon occurs as very fine-grained, subequant to elongated-prismatic, doubly-terminated euhedra in the higher amperage fractions (figs. 24o-p). This mineral ranges from clear to translucent and from white to pink in color. Zircon crystals are notably smaller than the other minerals in the concentrates. Its distribution in various magnetic fractions is a function of the relative abundance of inclusions, such as magnetite, that are more magnetically susceptible than the zircon. Zircon is more abundant in the Yakutat samples than in the Yakataga samples, but the maximum value is still very small: 0.35 percent of the characterized bulk samples from Yakutat. Samples from the Mt. Fairweather area contain notably less zircon than the other two areas.

The bulk of the spiral concentrate sand, from throughout the study area, consists of polyminerallic grains. These "rock fragments" include a variety of igneous and metamorphic rock types, revealing the range of source rocks in the region. Complex magmatic exsolution textures (figs. 24b,e,j), intergrowths, and interlocked grains of magnetite, pyroxene, plagioclase, sphene, and ilmenite suggest a layered ultramafic source, possibly the Crillon-La Perouse gabbro and related magmatic complexes south and east of the study area. Metamorphic rock fragments, including quartz-mica-garnet schist and kyanite-bearing schist, may have been derived from a number of metamorphic terranes in the region.

Ilmenite composition

The ratio of iron to titanium (Fe:Ti) in ilmenite is an important characteristic to measure in order to determine the quality of ilmenite for pigment production. Stoichiometric ilmenite, or ilmenite that is pure and unaltered and has the true theoretical chemical composition, has a Fe:Ti ratio of 1.165[14]. Chemical and physical weathering processes may alter this ratio by removing iron and leaving the grain enriched in titanium. Weathered, high-titanium ilmenite is obviously more economically attractive than stoichiometric ilmenite.

Although only a limited number of samples were studied in the detail necessary to determine ilmenite composition (31 samples, Appendix E), some trends are evident. Throughout the study area, ilmenite contains manganese contamination, or atomic substitution, possibly as a solid solution with *pyrophanite* ($MnTiO_3$). Some of the ilmenite studied contained up to 11 percent manganese, where manganese + titanium + iron = 100 percent. Other trace impurities in ilmenite include silicon, chromium, vanadium, and aluminum. At Cape Yakataga, the average Fe:Ti ratio of ilmenite is 1.385, with an average of 1.8 percent manganese, but great variations exist. Ilmenite that occurs in the hand magnetic fraction has an average Fe:Ti ratio of 1.791. In the next magnetic fraction, the 0.05 ampere fraction, the average ratio is 1.270. At a still higher magnetic amperage (0.15 A), the average ratio is 1.094. These samples show a progressive increase in relative titanium content of the ilmenite in higher amperage magnetic fractions. At Yakutat, the average Fe:Ti ratio of ilmenite is 1.099, with an average of 2.7 percent manganese. In the hand magnetic fraction, the Fe:Ti ratio of ilmenite is 1.062. In the next two magnetic fractions, the 0.05 ampere and 0.15 ampere fractions, the average ratios are 1.180 and 1.212, respectively. These averages do not show a regular progression of increasing titanium content as the Cape Yakataga samples do. Ilmenite in the 0.30 ampere fraction of the Yakutat samples has an average Fe:Ti ratio of 0.915, which is dramatically enriched in titanium relative to the other magnetic fractions. No data were available on ilmenite composition in the 0.30 ampere fraction of the Cape Yakataga samples.

Geochemistry

Geochemical analyses were performed on a suite of 114 magnetic fractions of the samples from the Yakataga and Yakutat areas (Appendix D), in order to assess the effectiveness of magnetic fractionation in isolating heavy mineral species, and to test for trace occurrences of valuable heavy minerals. The magnetic fractions, labelled 1 through 6, were generated by passing the sample through a Frantz Laboratory Magnetic Barrier Separator, as described above. Fraction 1 is a combination of the hand magnetic and 0.05 ampere fractions; fraction 2 is the 0.15 ampere fraction; fraction 3 is the 0.30 ampere fraction; fraction 4 is the 0.50 ampere fraction; fraction 5 is a combination of the 0.70, 1.00, and 1.50 ampere fractions; fraction 6 is the nonmagnetic fraction.

The distribution of Fe_2O_3 varies systematically with magnetic field strength (fig. 26). The most magnetic fractions (1, 2, and 3) have the largest iron contents, presumably in magnetite and ilmenite. The less magnetic fractions (4, 5, and 6) have progressively lower iron content, probably associated with amphibole group minerals, altered ilmenite, and rutile.

---

[14] Calculated from the composition of ilmenite expressed in A Textbook of Mineralogy by E. S. Dana. Fe = 53.8%, Ti = 46.2%. These numbers are expressed as weight percent (less oxygen).

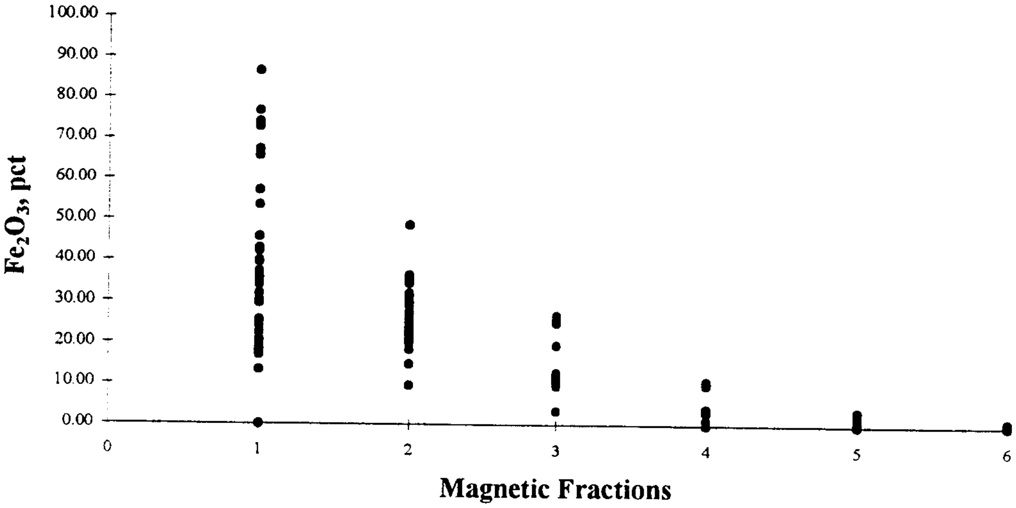


Figure 26. -- Graph of Fe_2O in magnetic fractions.

The Fe:Ti ratio is a good indicator of the presence (or absence) of ilmenite and altered ilmenite (fig. 27). Variability is high in all magnetic fractions, but the Fe:Ti ratio generally decreases in the higher magnetic fractions (4, 5, and 6). The Fe:Ti ratios suggest that ilmenite (52.7 pct TiO_2, Fe:Ti = 1.165) is less abundant than more Fe-rich minerals in fractions 1, 2, and 3, and that the principal minerals in these fractions are magnetite, titanomagnetite, and intergrown ilmenite-hematite phases.

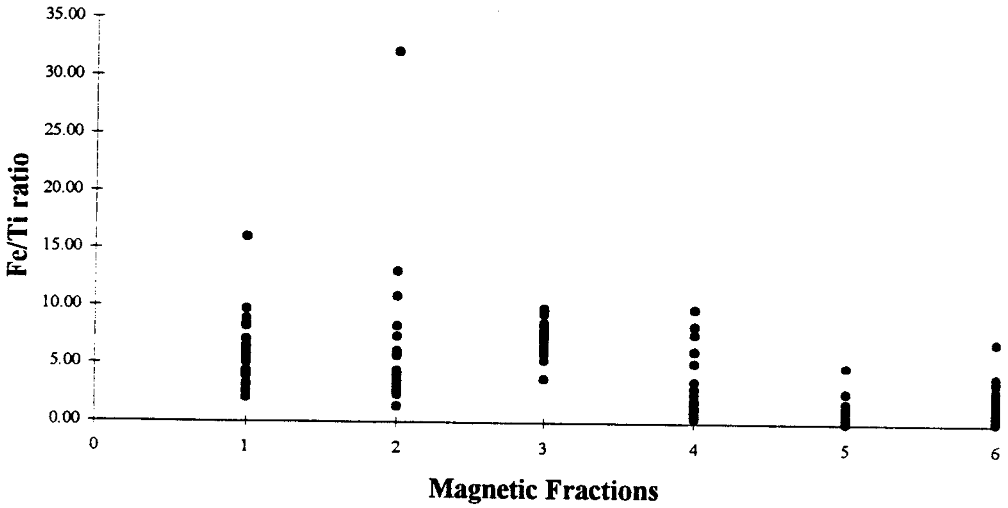


Figure 27. -- Graph of Fe:Ti ratios in magnetic fractions.

The distribution of TiO_2 in the magnetic fractions varies as a function of the abundances of titanium-bearing minerals (fig. 28). Fractions 1 and 2 contain the largest quantities of titanomagnetite, Fe-rich ilmenite, and intergrown ilmenite-hematite grains and therefore have the largest absolute values and the widest ranges of titanium values. Fraction 3 is generally enriched in amphibole group minerals with respect to other magnetic fractions and thus contains lower titanium values. Fractions 4, 5, and 6 contain sphene, altered ilmenite, and rutile; the distribution of titanium in these fractions is controlled by the relative abundance of these minerals. The range of titanium values in all the magnetic fractions is influenced by the diluting effect of significant but variable quantities of quartz, feldspar, and polymineralic grains.

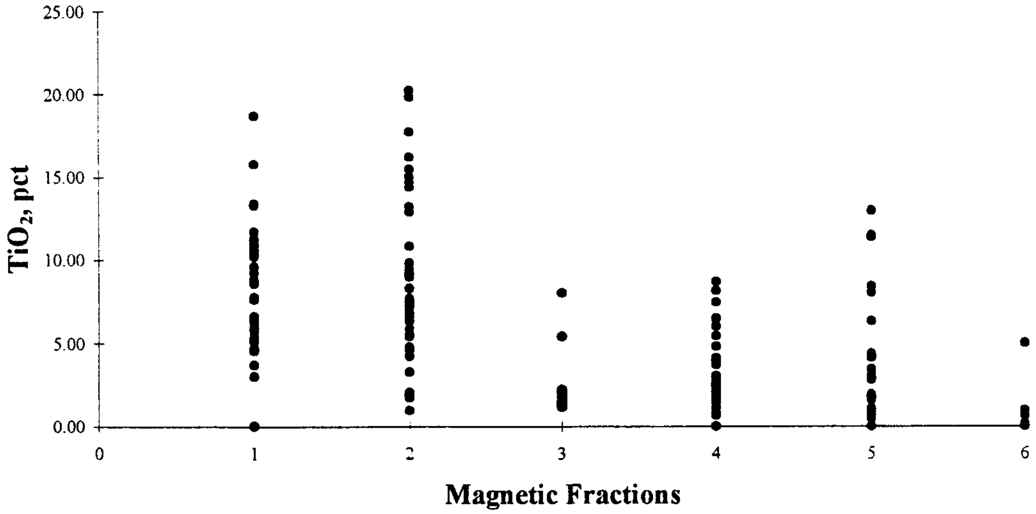


Figure 28. -- Graph of TiO_2 in magnetic fractions.

The distribution of zirconium (a principal and diagnostic component of the mineral zircon) in the magnetic fractions document the relative abundance of this mineral (fig. 29). The presence of zirconium in magnetic fractions 1, 2, and 3 can be explained by the observations that the zircon grains have magnetite inclusions and zircon is present as inclusions in magnetite, ilmenite, and amphibole-group minerals. Alternatively, zirconium may be present in trace quantities in amphibole-group minerals that are common in these fractions. The presence and relative abundance of zirconium in fractions 4, 5, and 6 is consistent with the relative abundances of zircon in these magnetic fractions, as determined mineralogically.

The presence of monazite in sediment samples from Yakataga and Yakutat has been documented by previous studies, as well as by this study. The quantification of monazite in the samples collected in this study, however, was hampered by the low frequency of occurrence and the abundance of quartz and feldspar in the concentrate, especially magnetic fractions 4 and 5, where monazite is commonly found (fig. 30). The distribution of rare-earth elements in the

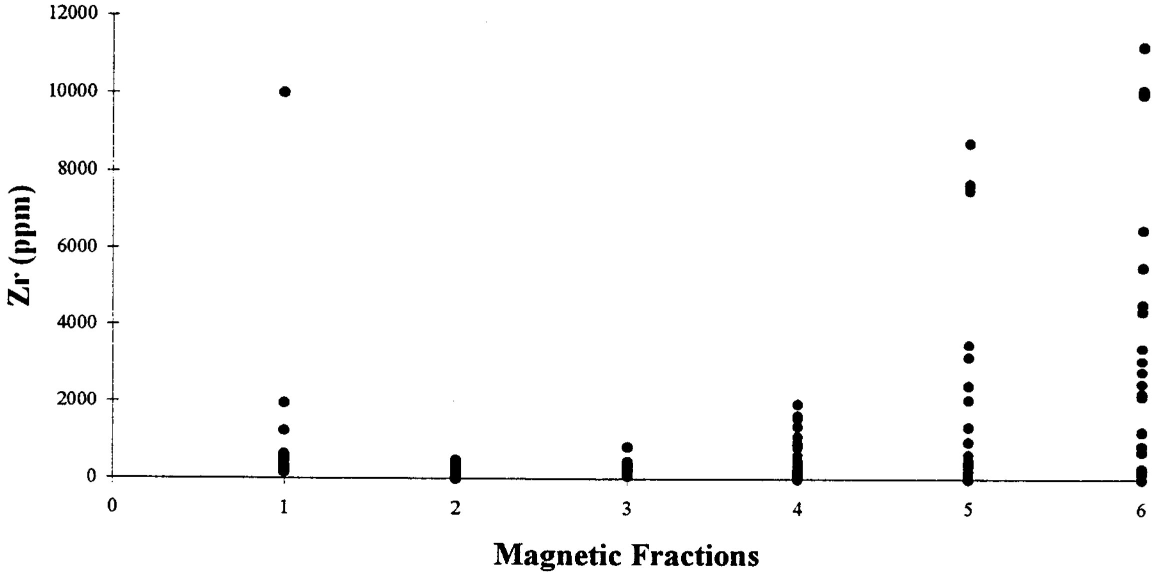


Figure 29. -- Graph of Zr in magnetic fractions.

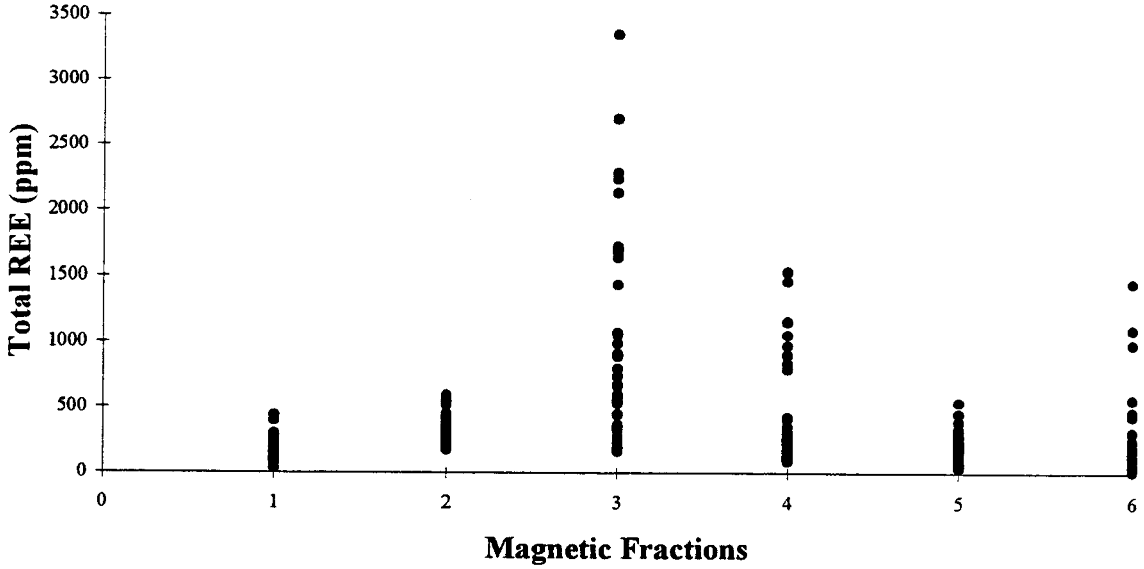


Figure 30. -- Graph of rare-earth elements in magnetic fractions.

magnetic fractions is consistent with and predictive of the presence of monazite. The ratio between cerium and lanthanum in all magnetic fractions from the Cape Yakataga and Yakutat samples is approximately 2:1 (fig. 31). This ratio is consistent with that for monazite. These chemical data suggest that monazite is present and relatively abundant in these samples. The relation between cerium and thorium (fig. 32) provides supporting evidence for the presence of monazite and suggests that airborne gamma-ray radiation surveys of the sampled areas could help locate sites with heavy mineral concentrations.

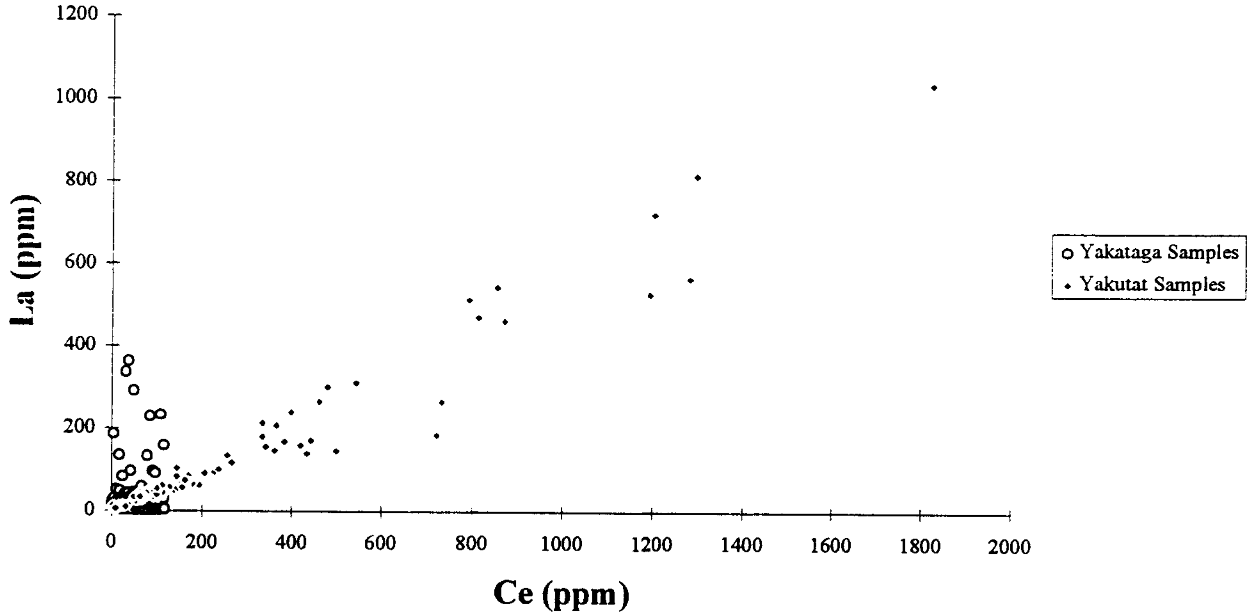


Figure 31. -- Graph of Ce vs. La in magnetic fractions.

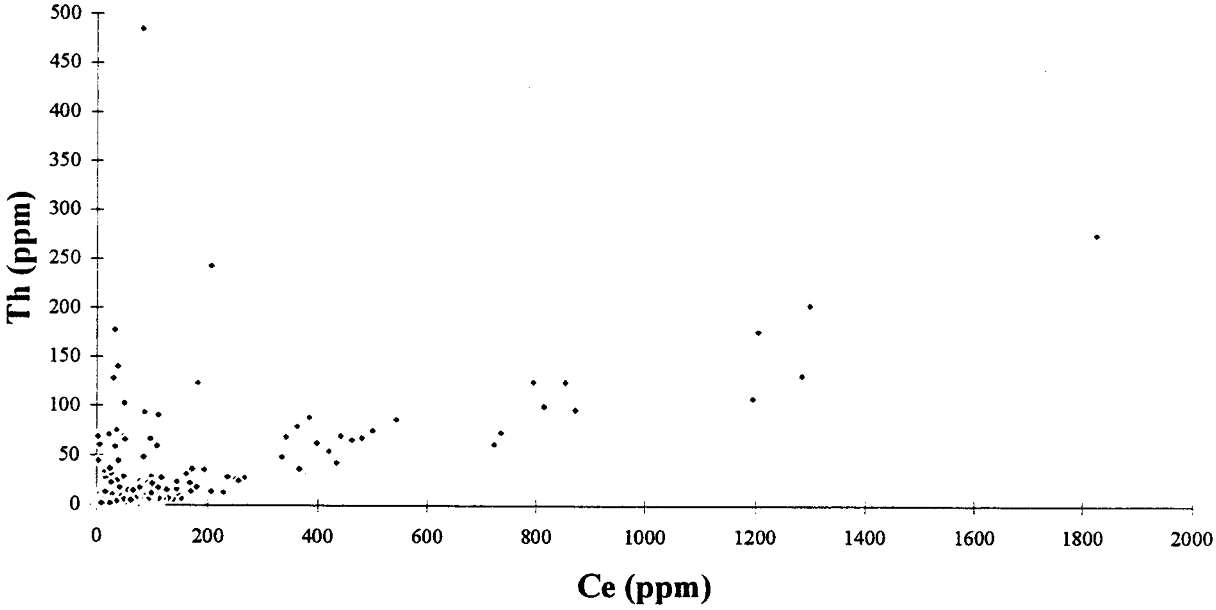


Figure 32. -- Graph of Ce vs.Th in magnetic fractions.

Titanium and associated heavy-mineral resources

During this study, potential titanium and associated heavy-mineral resources have been identified and characterized. Optical and scanning-electron microscopy studies have identified ilmenite, rutile, and zircon as potentially economic minerals in spiral concentrates from modern beaches and inland beach terraces. Associated with these heavy minerals are potentially valuable garnet and precious metals. Geochemical data reflect mineralogic trends throughout the province.

The deposits include modern accumulations along the active shoreline and in older inland deposits beneath the coastal plain. Because the inland deposits are more difficult to access, most samples were collected from the modern occurrences. For these reasons, quantitative resource estimates can only be provided for the modern deposits. The sizes and compositions of these deposits serves to characterize the heavy-mineral province and may be considered an indication of the character of the remaining unmeasured resources.

A comparison of the chemical and mineralogical character of the "concentrates" revealed that a significant but unknown mass of the valuable heavy minerals was rejected by the spiral. These studies therefore provide a minimum value for the heavy-mineral resources of the beaches in this region.

The Gulf of Alaska coastline is a highly dynamic depositional environment, producing large variations in the heavy-mineral content and morphology of the modern deposits. The dynamic nature of the modern deposits precludes accuracy in measurements of any kind and limits the value of any detailed assessment. Because the inland deposits were deposited in similar sedimentary environments as the modern deposits, similar variation of heavy-mineral content can be expected to prevail in the inland areas.

Processing methods and costs were not evaluated during this study. More detailed sampling of the inland deposits and laboratory or pilot plant tests would be required to assess these factors.

Mineralogical and chemical data assembled in this report allow comparison of the characterized deposits to producing heavy-mineral deposits (Fantel and others, 1986; Force, 1991). The magmatic origin of the titanium minerals has resulted in characteristically low titanium content of ilmenite and related titanium oxide minerals in the deposit. Also inclusions in the titanium minerals and zircon would likely detract from the value of heavy-mineral concentrates or add to the cost of processing. The abundance of near-stoichiometric ilmenite and other iron-rich titanium oxide minerals would yield heavy mineral concentrates more similar to those processed at Sorel, Quebec, and Richards Bay, South Africa than to high-titanium concentrates derived from erosion of high-grade metamorphic rocks (for example, deposits in Australia and the eastern United States). Because of low titanium content of magmatic ilmenite, processing of concentrates at Sorel and Richards Bay requires a slagging process prior to pigment production by sulfate processes. Similar processing would likely be required to produce marketable titanium concentrates from the Gulf of Alaska deposits. High calcium and magnesium contents may interfere with such processing or may require additional processing prior to pigment production.

Total estimated resources in the study area include 450 to 500 million metric tons of unconsolidated sand with varying amounts of valuable heavy minerals. Variations in heavy mineral content are sumarized below for the Cape Yakataga, Yakutat and Cape Fairweather areas.

Estimated resources in the Cape Yakataga area include a 35-km wedge-shaped body of sand in modern shoreline deposits between the Duktoth River and Johnson Creek at the west side of Icy Cape and another sparsely sampled stretch of coast along Icy Cape (25 km). Therefore, modern deposits in this area measure 35 km to 60 km long x 250 m wide x 10 m thick. These measurements yield volumes of 43 million to 75 million m^3. With an assumed specific gravity of 1.6, 68 million to 120 million metric tons are inferred in these modern shoreline deposits. From Icy Bay to the Yana River, at the eastern end of the Cape Yakataga area, is another 22 km shoreline interval with 90 million metric tons and heavy-mineral content similar to the Cape Yakataga area. Between the Duktoth and Kaliakh Rivers, at the western end of the Cape Yakataga area, is a 19 km shoreline interval with 38 million metric tons. Samples from the Cape Yakataga area contain an average of 0.57 percent valuable heavy minerals (ilmenite, rutile, and zircon), with a range of 0.02 to 2.9 percent. Compared to other deposits, these would be medium to large, low-grade heavy mineral resources. Inland of the modern deposits are strandline bodies of comparable size that formed repeatedly in the past during periods of transgression and regression. Especially noteworthy is the expansive coastal plain at Icy Cape. Titanium, zirconium, and gold assays for samples from this area (samples HA92YK 185 and HA92YK 186 from location 153, Appendix A) indicate that valuable heavy minerals, including gold, are present.

Beaches near Yakutat are broader than in the Cape Yakataga area, averaging about 300 m wide, and extend for 24 km along the coast. We again assume a wedge-shaped prism from 0 to 11 m deep, which gives a total of 36 million m^3 of beach sand. This equates to 57 million metric tons of sand, with an average of 3.4 percent valuable heavy minerals, ranging from 0.2 to 14.8 percent. A similar, less densely sampled stretch of shoreline from the Situk River to Boussole Bay is estimated to contain 192 million metric tons with about 3 percent valuable heavy minerals. Compared with other such deposits around the globe, these are significant heavy-mineral deposits. Inland of the modern shoreline between Yakutat and Cape Fairweather are broad stretches of coastal plain. Little is known about the heavy-mineral content of these areas but chemical and mineralogical data for sparse samples (HA93GA 067, HA93GA 041, HA93GA 056, and RK93GA 026) indicate that greater than 1 percent valuable heavy minerals are present.

SUMMARY AND CONCLUSIONS

Valuable heavy minerals including predominant ilmenite, with less abundant rutile and zircon, are contained in low-grade medium to large sized modern shoreline deposits along a 375 km portion of the eastern Gulf of Alaska coastline. Total estimated resources in the modern deposits are 450-500 million metric tons. Recovered heavy minerals in characterized samples range from 0.02 to 15 percent and average from 0.6 percent to 3.4 percent over large areas. Unmeasured resources of comparable size and grade are present inland of the modern deposits, beneath a coastal plain that measures as much as 25 km in width. Chemical analyses of spiral rejects indicate that significant amounts of valuable heavy minerals were not recovered during sample processing. These deposits also contain several percent garnet, less than 1 percent monazite, small amounts of gold (less than 1 g/t), and trace platinum-group metals.

The Gulf of Alaska deposits are not typical of most producing titanium deposits. They are Tertiary and Quaternary in age and occur in a geologically immature region. Ilmenite grains in heavy-mineral concentrates contain 50 percent or less TiO_2. The low TiO_2 content, the abundant presence of inclusions in the mineral grains, and complex intergrowths including exsolution textures indicate that ilmenite and associated heavy minerals are derived from magmatic sources, probably the Crillon-La Perouse gabbro and similar Tertiary mafic complexes in southeastern Alaska. These features distinguish the deposits from TiO_2-rich ilmenite and rutile deposits derived from high-grade metamorphic rocks. The Gulf of Alaska deposits occur in a convergent plate margin setting instead of on a trailing plate or passive margin as do most producing titanium placers. Because of this, the deposits do not possess the advantage of winnowing and concentration of heavy minerals by repeated transgressions and regressions over a broad, 100-km-wide or wider coastal plain as do the Australian and southeastern United States deposits. Exploitation and depletion of the more desirable deposits in the past and near future may make deposits like those in the Gulf of Alaska more attractive. Titanium is produced from deposits similar to the Gulf of Alaska deposits in Canada and South Africa. It is anticipated that deposits of this type will become more important in the future.

BIBLIOGRAPHY

Alaska Department of Natural Resources. Yakataga Area Plan, Minerals and Materials Resources Report, Draft. March, 1993, 39 pp.

Alaska Department of Natural Resources. Yakataga Area Plan, Public Review Draft. June, 1993, 286 pp.

Arendt, J.W., T.R. Butz, G.W. Cagle, V.E. Kane, and C.E. Nichols. Hydrogeochemical and Stream Sediment Reconnaissance Procedures of the Uranium Resource Evaluation Project. U.S. Department of Energy, GJBX-32(80), 1980, 53 p.

Averett, W.R. National Uranium Resource Evaluation Guide to Data Reports of the Hydrogeochemical and Stream Sediment Reconnaissance. U.S. Department of Energy, GJBX-5(84), 1984, 119 p.

Beikman, H.M. Geologic Map of Alaska. U.S. Geological Survey, 1980, 2 sheets, scale 1:2,500,000.

Berg, H.C., D.L. Jones, and D.H. Richter. Gravina-Nutzotin Belt – Tectonic Significance of an Upper Mesozoic Sedimentary and Volcanic Sequence in Southern and Southeastern Alaska. U.S. Geological Survey Professional Paper 800-D, 1972, 24 pp.

Blackwelder, Eliot. Reconnaissance of the Pacific Coast from Yakutat to Alsek River. U.S. Geological Survey Bulletin 314-D, 1907, pp. 15, and 82-88.

Brew, D.A., B.R. Johnson, Donald Grybeck, Andrew Griscom, and D.F. Barnes. Mineral Resources of the Glacier Bay National Monument. U.S. Geological Survey Open-File Report 78-494, 1978, 670 pp.

Brew, D.A., and R.P. Morrell. Intrusive Rocks and Plutonic Belts of Southeastern Alaska, U.S.A. U.S. Geological Survey Open-File Report 80-78, 1980, 34 pp.

Bruns, T.R. and George Plafker. Preliminary Structural Map of the Offshore Gulf of Alaska Tertiary Province. U.S. Geological Survey Open-File Report no. 75-508, 1975, 7 pp., 1 sheet, scale 1:500,000.

Clifton, H.E. and G. Luepke. Heavy-Mineral Placer Deposits of the Continental Margin of Alaska and the Pacific Coast States. Ch. in Geology and Resource Potential of the Continental Margin of Western North America and Adjacent Ocean Basins – Beaufort Sea to Baja California, ed. by D.W. Scholl, Arthur Grantz, and J.G. Vedder. Circum-Pacific Council for Energy and Mineral Resources Earth Science Series, v. 6, 1987, pp. 691-738.

Cobb, E.H.(a). Metallic Mineral Resources Map of the Bering Glacier Quadrangle, Alaska. U.S. Geological Survey Miscellaneous Field Studies Map MF-373, 1972, 1 sheet, scale 1:250,000.

_____ (b). Metallic Mineral Resources Map of the Icy Bay Quadrangle, Alaska. U.S. Geological Survey Miscellaneous Field Studies Map MF-411, 1972, 1 sheet, scale 1:250,000.

_____ (c). Metallic Mineral Resources Map of the Yakutat Quadrangle, Alaska. U.S. Geological Survey Miscellaneous Field Studies Map MF-408, 1972, 1 sheet, scale 1:250,000.

Cook, D.J. Heavy Minerals in Alaskan Beach Sand Deposits. University of Alaska Minerals Industry Research Laboratory Report 20, 1969, 114 pp.

_____. Design of a Beneficiation System for Evaluation and Recovery of Gold and Accessory Minerals from Alaskan Beach Deposits. U.S. Bureau of Mines Contract Report H0122104, 1975, 16 pp.

Cox, D.P. and D.A. Singer. Mineral Deposit Models. U.S. Geological Survey Bulletin 1693, 1986, 379 pp.

Czamanske, G.K., J.H. Haffty, and S.W. Nabbs. Pt, Pd, and Rh Analyses and Beneficiation of Mineralized Mafic Rocks from the La Perouse Layered Gabbro, Alaska. Economic Geology, v. 76, 1981, pp. 2001-2011.

Dusel-Bacon, Cynthia. Metamorphic History of Alaska. U.S. Geological Survey Open-File Report 91-556, 1991, 2 sheets, scale 1:2,500,000.

Dusel-Bacon, Cynthia, Béla Csejtey, Jr., H.L. Foster, E.O. Doyle, W.J. Nokleberg, and George Plafker. U.S. Geological Survey Professional Paper 1497-C, 1993, 73 pp.

Eyles, N. Glacially Derived, Shallow-Marine Gold Placers of the Cape Yakataga District, Gulf of Alaska. Sedimentary Geology, v. 68, 1990, pp. 178-185.

Fantel, R.J., D.A. Buckingham, and D.E. Sullivan. Titanium Minerals Availability – Market Economy Countries, A Minerals Availability Appraisal. U.S. Bureau of Mines Information Circular 9061, 1986, 48 pp.

Frey, E. Exploration of Iron Mountain Titaniferous Magnetite Deposits, Albany County, Wyoming. U.S. Bureau of Mines Report of Investigation 3968, 1946, 37 pp.

Foley, J.Y., L.E. Burns, and C.L. Schneider. Preliminary Report of Platinum-Group Element Occurrences in Alaska. Alaska Division of Geological and Geophysical Surveys Public Data File 89-20, 1989, 34 pp.

Force, E.R. Metamorphic Source Rocks of Titanium Placer Deposits–A Geochemical Cycle. Ch. in Geology and Resources of Titanium: U.S. Geological Survey Professional Paper 959-A, 1976, pp. A1-A10.

_____. Geology of Titanium Mineral Deposits. Geological Society of America Special Paper 259, 1991, 112 pp.

Force, E.R., and Larsen, C.E. A Paleoclimate-Source Terrane Model for Shoreline Placer Deposits of Titanium Minerals, and Implications for Offshore Deposits: 12th International Sedimentological Congress, August, 1986, Canberra, Australia, Abstract, 1986, p. 109.

Giusti, L. The Morphology, Mineralogy, and Behavior of "Fine-Grained" Gold from Placer Deposits of Alberta: Sampling and Implications for Mineral Exploration. Canadian Journal of Earth Science, v. 23, 1986, pp. 1662-1672.

Gross, S.O. Titaniferous Ores of the Sanford Lake District, New York. Ch. in Ore Deposits in the United States, 1933-1967, The Graton-Sales Volume, ed. by J. D. Ridge. AIME, v. 1, 1968, pp. 140-153.

Grosz, A.E. Nature and Distribution of Potential Heavy-Mineral Resources Offshore of the Atlantic Coast of the United States. Marine Mining, v. 6, 1987, pp. 339-357.

Grosz, A.E., C.R. Berquist, Jr., and C.T. Fischler. A Procedure for Assessing Heavy-Mineral Resources Potential of Continental Shelf Sediments. Ch. in Heavy Mineral Studies - Virginia Inner continental Shelf, ed. by C.R. Berquist, Jr. Virginia Division of Mineral Resources Publication 103, 1990, pp. 13-30.

_____ (a). Use of Geochemical Surveys in Ti-Hf-REE-Th-U Placer Exploration – A Mid-Atlantic States Example. Ch. in Advances Related to United States and International Mineral Resources: Developing Frameworks and Exploration Technologies, ed. by R.W. Scott, Jr., P.S. Detra, and B.R. Berger. U.S. Geological Survey Bulletin 2039, 1993, pp. 181-188.

_____ (b). NURE Stream Sediment Geochemical Data Indicative of Prospective Terranes for Ti-Zr-REE Placer Exploration in Selected Regions of the United States. U.S. Geological Survey Open-File Report OF-93-240-A, 1993, 158 p. (paper copy).

_____ (c). NURE Stream Sediment Geochemical Data Indicative of Prospective Terranes for Ti-Zr-REE Placer Exploration in Selected Regions of the United States. U.S. Geological Survey Open-File Report OF-93-240-B, 1993, (diskette copy includes manuscript text and data).

Hagner, A.F. Host Rock as a Source of Magnetite Ore, Scott Mine, Sterling Lake, N.Y. Economic Geology, v. 58, 1963, pp. 730-768.

_____. The Titaniferous Magnetite Deposit at Iron Mountain, Wyoming. Ch. in Ore Deposits in the United States, 1933-1967, The Graton-Sales Volume, ed. by J. D. Ridge. AIME, v. 1, 1968, pp. 665-680.

Herz, Norman. Titanium Deposits in Alkalic Igneous Rocks. Ch. in Geology and Resources of Titanium. U.S. Geological Survey Professional Paper 959-E, 1976, p. E1-E6.

Himmelberg, G.R., and R.A. Loney. Petrology of the Ultramafic and Gabbroic Rocks of the Brady Glacier Nickel-Copper Deposit, Fairweather Range, Southeastern Alaska. U.S. Geological Survey Professional Paper 1195, 1981, 26 pp.

Hudson, Travis, George Plafker, and M.A. Lanphere. Intrusive Rocks of the Yakutat - St. Elias Area, South-Central Alaska. U.S. Geological Survey Journal of Research, v. 5, no. 2, 1977, pp. 155-172.

Hudson, Travis, George Plafker, and D.L. Turner. Metamorphic Rocks of the Yakutat - St. Elias Area, South-Central Alaska. U.S. Geological Survey Journal of Research. v. 5, no. 2, 1977, pp. 173-184.

Hwang, C.L. Design of a System for Evaluation and Recovery of Minerals From Beach Sand Deposits. Master of Science Thesis, University of Alaska, Fairbanks, Alaska. May, 1974, 77 pp; available upon request from J.Y. Foley, U.S. Bureau of Mines, Anchorage, AK.

Johnson, G.R. and George Plafker. Preliminary Geologic Interpretation of Aeromagnetic Data in the Yakutat District, Alaska. U.S. Geological Survey Open-File Report 69-134, 1969, 14 pp., 4 sheets, scale 1:63,360.

Jones, D.L., N.J. Silberling, P.J. Coney, and George Plafker. Lithotectonic Terrane Map of Alaska (West of the 141st Meridian). U.S. Geological Survey Miscellaneous Field Studies Map MF-1874A, 1987, 1 sheet, scale 1:2,500,000.

Kramer, D.A. Titanium. Ch. in U.S. Bureau of Mines Minerals Yearbook 1990, 1992, 22 pp.

Lynd, L.E. Titanium, Mineral Facts and Problems: U.S. Bureau of Mines, Bulletin 675, 1985, p. 859-879.

Macdonald, E.H. Alluvial Mining – The Geology, Technology, and Economics of Placers: Chapman and Hall, London, 1983, 508 p.

MacKevett, E.M., Jr. and George Plafker. Geochemical and Geophysical Reconnaissance of Parts of the Yakutat and St. Elias Quadrangles, Alaska. U.S. Geological Survey Bulletin 1312-L, 1970, 12 pp.

_____. The Border Ranges Fault in South-Central Alaska. U.S. Geological Survey Journal of Research, v. 2, 1974, pp. 323-329.

Maddren, A.G. Mineral Deposits of the Yakataga District. Ch. in Mineral Resources of Alaska, Report of Progress of Investigations in 1913, compiled by A.H. Brooks. U.S. Geological Survey Bulletin 592, 1914, pp. 119-153.

Martin, G.C. The Cape Yaktag Placers. U.S. Geological Survey Bulletin 259, 1904, pp. 88-89.

Miller, D.J. Preliminary Report on the Geology and Oil Possibilities of the Katalla District, Alaska. U.S. Geological Survey Open-File Report 51-20, 1951.

_____. Preliminary Geologic Map and Structure Sections of the Bering Glacier A-2, A-3, and A-4 and Icy Bay D-2 - D-3 Quadrangles, Yakataga District, Alaska. U.S. Geological Survey, 1953, scale 1:63,360.

_____. Preliminary Report on the Geology and Oil Possibilities of the Yakataga District, Alaska. U.S. Geological Survey Open-File Report 51-39, 1951, 48 pp.

_____. Geology of the Southeastern Part of the Robinson Mountains, Yakataga District, Alaska. U.S. Geological Survey Oil and Gas Investigations Map OM 187, 1957, 2 sheets, scale 1:63.360.

_____. Geology of the Katalla District, Gulf of Alaska Tertiary Province, Alaska. U.S. Geological Survey Open-File Report 61-99, 1961, 2 sheets, scale, 1:96,000.

_____. Geology of the Malaspina District, Gulf of Alaska Tertiary Province, Alaska. U.S. Geological Survey Open-File Report 61-101, 1961, 2 sheets, scale, 1:96,000.

_____. Geology of the Yakutat District, Gulf of Alaska Tertiary Province, Alaska. U.S. Geological Survey Open-File Report 61-103, 1961, 2 sheets, scale 1:96,000.

_____. Geologic Map of the Yakataga District, Gulf of Alaska Tertiary Province, Alaska. U.S. Geological Survey Miscellaneous Geologic Investigations Map I-610, 1971, 6 pp., 1 sheet, scale 1:125,000.

_____. Geologic Map and Sections of the Central Part of the Katalla District, Alaska. U.S. Geological Survey Miscellaneous Field Studies Map MF-722, 1975.

Miller, D.J., T.G. Payne, and George Gryc. Geology of Possible Petroleum Provinces in Alaska. U.S. Geological Survey Bulletin 1094, 1959, 131 pp.

Minter, W.E L., Goedhart, M., Knight, J., and Frimmel, H.E. Morphology of Witwatersrand Gold Grains from the Basal Reef: Evidence for their Detrital Origin. Economic Geology, v. 88, 1993, p. 237-248.

Molnia, B.F. Rapid Shoreline Erosion and Retreat at Icy Bay, Alaska – A Staging Area For Offshore Petroleum Development. Offshore Technology Conference Paper 2892, 1977, 7 pp.

Monger, J.W.H. and H.C. Berg. Lithotectonic Terranes of Western Canada and Southeastern Alaska. U.S. Geological Survey Miscellaneous Field Studies Map MF-1874-B, 1987, 12 pp., 1 sheet, scale 1:2,500,000.

Moxham, R.M and A.E. Nelson. Radioactive Pegmatite Minerals in the Yakataga Beach Placers, Reconnaissance for Radioactive Deposits in South-Central Alaska. U.S. Geological Survey Circular 184, 1952, pp. 11-14.

Osborne, F.F. Certain Titaniferous Iron Ores and Their Origin. Economic Geology, v. 23, 1928, pp. 728-740.

Overstreet, W.C. The Geologic Occurrence of Monazite. U.S. Geological Survey Professional Paper 530, 1967, 327 p.

Overstreet, W.C., A.M. White, J.W. Whitlow, P.K. Theobald, Jr., D.W. Caldwell, and N.P. Cupples. Fluvial Monazite Deposits in the Southeastern United States. U.S. Geological Survey Professional Paper 568, 1968, 85 p.

Plafker, George. Pacific Margin Tertiary Basins. Ch. in Future Petroleum Provinces of North America. American Association of Petroleum Geologists Memoir 15, 1971, pp. 120-135.

_____. Geologic Map of the Gulf of Alaska Tertiary Province, Alaska. U.S. Geological Survey Miscellaneous Geological Investigations Map I-484, 1967, 1 sheet, scale 1:500,000.

Plafker, George, and E.M. MacKevett, Jr. Mafic and Ultramafic Rocks from a Layered Pluton at Mt. Fairweather, Alaska. U.S. Geological Survey Professional Paper 700-B, 1970, pp. 21-26.

Plafker, George, and D.J. Miller. Reconnaissance Geology of the Malaspina District, Alaska. U.S. Geological Survey Oil and Gas Investigations Map OM 189, 1957, 1 sheet, scale 1:125,000.

_____. Glacial Features and Surficial Deposits of the Malaspina District, Alaska. U.S. Geological Survey Miscellaneous Geological Investigations Map I-271, 1958, 1 sheet, 1:125,000.

Plafker, George, D.L. Jones, Travis Hudson, and H.C. Berg. The Border Ranges Fault

System in the St. Elias Mountains and Alexander Archipelago. Ch. in The United States Geological Survey in Alaska: Accomplishments During 1975, ed. by E.H. Cobb. U.S. Geological Survey Circular 733, 1976, pp. 14-16.

Plafker, George, D.L. Jones, and E.A. Pessagno, Jr. Cretaceous Accretionary Flysch and MelangeTerrane Along the Gulf of Alaska Margin. Ch. in The United States Geological Survey in Alaska, ed. by K.M. Blean. U.S. Geological Survey Circular 751-B, 1977, pp. 41-43.

Reimnitz, E., and George Plafker. Marine Gold Placers Along the Gulf of Alaska Margin. U.S. Geological Survey Bulletin 1415, 1976, 16 pp., 1 sheet, scale 1:1,000,000.

Renshaw, A.L. Assessment of Mineral Potential and Geology: Northerly Gulf of Alaska Coastal Area. U.S. Bureau of Mines Contract Report, 1978, 133 pp.

Rossman, D.L. Geology and Petrology of Two Stocks of Layered Gabbro in the Fairweather Range, Alaska. U.S. Geological Survey Bulletin 1121-F, 1963, 50 pp.

Seis-Tech Exploration Company, Inc. Report of Seismograph Survey in the Yakutat-Dry Bay Area, Southeast Alaska – Dry Bay, Dangerous river, Malaspina, for Colorado Oil and Gas corporation. department of Interior Development Contract (unpublished), 1959.

Slingerland, Rudy. Role of Hydraulic Sorting in the Origin of Fluvial Placers: Journal of Sedimentary Petrology, v. 54, 1984, pp. 137-150.

Standard Oil Company of California, Western Operations, Inc. Summary Report of Evaluation of the St. Elias Development contract Area. Department of Interior Development Contract (Unpublished), 1963.

Taliaferro, N.L. Geology of the Yakataga, Katalla, and Nichawak District, Alaska. Geological Society of America Bulletin, v. 43, 1932, pp. 749-782.

Tarr, R.S. The Yakutat Bay Region, Progress of Investigations of Mineral Resources of Alaska in 1905. U.S. Geological Survey Bulletin 284, 1905, pp. 61-64.

Tarr, R.S. and B.S. Butler. The Yakutat Bay Region. U.S. Geological Survey Professional Paper 64, Part 2. 1909, 183 pp.

Thomas, B.I. and R.V. Berryhill. Reconnaissance Studies of the Alaskan Beach Sands, Eastern Gulf of Alaska. U.S. Bureau of Mines Report of Investigations 5986, 1962, 40 pp.

Thompson, A.G. Yakataga Beach Placers. Mining Journal, v. 99, no. 18, 1915, pp. 763-765.

Tysdal, R.G., Travis Hudson, and George Plafker. Surface Features and Recent Movement Along the Ragged Mountain Fault, South-Central Alaska. U.S. Geological Survey Miscellaneous Field Studies Map MF-782, 1976,1 sheet, scale 1:24,000.

Vincent, E.A. and R. Phillips. Iron-Titanium Oxide Minerals in Layered Gabbros of the Skaergaard Intrusion, East Greenland. Geochemica et Cosmochimica Acta, v. 6, 1954, pp. 1-26.

Vlasov, K.A., ed., Geochemistry and Mineralogy of Rare Elements and Genetic Types of Their Deposits [translated from Russian by Z. Lerman and Y. Brenner, Israel Program for Scientific Translations]: Jerusalem, Israel, 1966, 1633 pp.

Wright, F.F. Marine Geology of Yakutat Bay, Alaska. U.S. Geological Survey Professional Paper 800-B, 1972, pp. 9-15.

Yeend, W.E. Gold-Bearing Gravel of the Ancestral Yuba River, Sierra Nevada, California. U.S. Geological Survey Professional Paper 772, 1974, 41 pp.

Yehle, L.A. Reconnaissance Engineering Geology of the Yakutat Area, Alaska, with Emphasis on Evaluation of Earthquake and other Geologic Hazards. U.S. Geological Survey Professional Paper 1074, 1979, 44 pp., 1 sheet, scale 1:63,360.

Appendix A. -- Map numbers, sample numbers, sampled intervals, and results of chemical analyses for head and spiral concentrate splits of eastern Gulf of Alaska samples

Map	Sample	Top	Bottom	Sampled	Head Splits			Spiral Concentrate Splits		
Number	Number	(m)	(m)	Interval (m)	Au (g/t)	Ti (pct)	Zr (ppm)	Au (g/t)	Ti (pct)	Zr (ppm)
1	RS93GA 076	0.0	0.2	0.2	<0.028	0.49	262	0.536	0.75	4026
2	RS93GA 075	0.0	0.2	0.2	<0.028	0.58	176	1.721	0.68	591
3	HA93GA 073	0.0	1.5	1.5	<0.028	0.23	83	0.395	0.46	188
4	HA93GA 072	0.0	1.5	1.5	<0.028	0.40	106	0.028	0.67	281
5	HA93GA 074	0.0	1.5	1.5	<0.028	0.31	110	0.339	0.53	215
6	HA93GA 071	0.0	2.4	2.4	<0.028	0.40	294	<0.028	1.06	2342
7	HA93GA 070	0.0	2.4	2.4	0.028	0.38	218	0.282	1.21	2076
8	RS93GA 077	2.4	0.0	0.2	<0.028	0.41	189	0.113	0.50	1359
9	RS93GA 078	0.0	0.2	0.2	<0.028	0.47	160	0.452	0.50	392
10	HA92YK 196	0.0	0.5	0.5	0.085	0.66	234	<0.028	0.92	1621
11	PA92YK032.1	0.0	2.1	2.1	<0.028	0.32	171	<0.028	0.61	486
11	PA92YK032.2	2.1	4.0	1.8	<0.028	0.38	205	<0.028	0.55	612
11	PA92YK032.3	4.0	5.8	1.8	<0.028	0.38	187	0.282	0.58	664
12	HA92YK 197	0.0	0.3	0.3	<0.028	0.80	143	<0.028	0.85	876
13	HA92YK 198	0.0	0.5	0.5	<0.028	0.76	162	0.085	0.76	957
14	HA92YK 199	0.0	0.3	0.3	0.085	0.68	201	0.169	0.71	985
15	HA92YK 200	0.0	0.6	0.6	<0.028	0.67	184	<0.028	0.79	852
16	PA92YK001.1	0.0	1.1	1.1	<0.028	0.37	192	<0.028	0.61	537
16	PA92YK001.2	1.1	4.3	3.2	<0.028	0.37	201	<0.028	0.73	767
16	HA92YK 101	0.0	0.9	0.9	<0.028	0.57	174	<0.028	0.56	370
17	PA92YK002.1	0.0	2.4	2.4	<0.028	0.37	169	0.169	0.68	682
17	PA92YK002.2	2.4	4.3	1.8	<0.028	0.38	166	<0.028	0.81	664
17	HA92YK 102	0.0	0.9	0.9	<0.028	0.66	216	<0.028	0.85	812
18	PA92YK003.1	0.0	2.7	2.7	<0.028	0.44	329	0.282	1.02	2307
18	PA92YK003.2	2.7	4.9	2.1	<0.028	0.42	280	0.339	0.79	1437
18	HA92YK 103	0.0	1.2	1.2	<0.028	0.87	573	0.593	1.22	2923
19	RS92YK 195	0.0	0.0	0.0	<0.028	0.89	292	0.169	1.10	1320
20	PA92YK004.1	0.0	1.8	1.8	0.226	0.67	940	0.677	1.54	3855
20	PA92YK004.2	1.8	2.7	0.9	0.452	0.69	939	0.056	1.49	3670
20	HA92YK 107.1	0.0	0.9	0.9	<0.028	1.11	854	0.169	2.21	6363
20	HA92YK 107.2	0.9	1.8	0.9	0.141	1.48	1419	0.056	2.31	6490
20	HA92YK 107.3	1.8	2.4	0.6	<0.028	1.28	986	<0.028	1.68	3197
21	HA92YK 106	0.0	0.5	0.5	0.677	1.32	1031	0.903	2.09	7683
22	HA92YK 105	0.0	0.3	0.3	0.056	0.92	449	<0.028	1.09	1349
23	HA92YK 104	0.0	0.3	0.3	<0.028	0.53	126	<0.028	0.52	243
24	HA92YK 108	0.0	0.3	0.3	0.141	1.20	319	<0.028	1.09	1019
25	HA92YK 109	0.0	0.3	0.3	0.310	1.94	1469	<0.028	2.32	5802
26	PA92YK006.1	0.0	0.5	0.5	0.169	0.46	488	0.198	0.87	1852
26	PA92YK006.2	0.5	1.4	0.9	0.339	0.35	221	<0.028	0.65	695
27	PA92YK005	0.0	1.4	1.4	0.113	0.67	1032	0.282	1.80	4992
28	HA92YK 111	0.0	1.8	1.8	0.480	0.98	509	0.423	1.28	3031
29	PA92YK007	0.0	0.9	0.9	<0.028	0.47	139	<0.028	0.82	762
30	PA92YK031.1	0.0	2.1	2.1	<0.028	0.55	164	<0.028	0.78	443
30	PA92YK031.2	2.1	4.0	1.8	<0.028	0.46	180	<0.028	0.73	492

NA - Not analyzed

Appendix A. -- Map numbers, sample numbers, sampled intervals, and results of chemical analyses for head and spiral concentrate splits of eastern Gulf of Alaska samples

Map	Sample	Top	Bottom	Sampled	Head Splits			Spiral Concentrate Splits		
Number	Number	(m)	(m)	Interval (m)	Au (g/t)	Ti (pct)	Zr (ppm)	Au (g/t)	Ti (pct)	Zr (ppm)
30	PA92YK031.3	4.0	5.8	1.8	0.056	0.53	296	0.198	0.88	945
30	PA92YK031.4	5.8	7.6	1.8	<0.028	0.47	217	<0.028	0.83	722
30	PA92YK031.5	7.6	9.8	2.1	<0.028	0.49	232	<0.028	0.85	618
31	HA92YK 113	0.0	1.8	1.8	<0.028	0.78	169	<0.028	0.83	790
32	HA92YK 112	0.0	0.3	0.3	<0.028	0.51	110	<0.028	0.58	264
33	HA92YK 116	0.0	1.5	1.5	<0.028	0.78	257	<0.028	1.65	2029
34	HA92YK 115	0.0	0.8	0.8	<0.028	0.66	127	0.056	0.56	401
35	HA92YK 114	0.0	0.9	0.9	<0.028	0.52	92	0.085	0.40	191
36	PA92YK008.1	0.0	1.2	1.2	<0.028	0.38	131	<0.028	0.53	581
36	PA92YK008.2	1.2	2.4	1.2	<0.028	0.47	215	<0.028	0.63	847
36	PA92YK008.3	2.4	3.4	0.9	<0.028	0.38	107	<0.028	0.50	326
36	PA92YK008.4	3.4	4.3	0.9	0.056	0.35	119	0.113	0.55	428
36	PA92YK008.5	4.3	5.2	0.9	<0.028	0.34	126	0.056	0.56	403
36	PA92YK008.6	5.2	7.0	1.8	0.198	0.35	190	<0.028	0.73	771
36	PA92YK008.7	7.0	9.4	2.4	<0.028	0.31	128	0.056	0.59	469
37	PA92YK009.1	0.0	1.8	1.8	<0.028	0.44	218	<0.028	0.79	1033
37	PA92YK009.2	1.8	3.7	1.8	0.395	0.54	249	0.085	1.01	1132
37	PA92YK009.3	3.7	5.5	1.8	<0.028	0.37	139	0.141	0.50	278
37	PA92YK009.4	5.5	7.3	1.8	0.056	0.37	143	<0.028	0.56	344
37	PA92YK009.5	7.3	9.1	1.8	<0.028	0.32	114	<0.028	0.50	349
38	CH92YK010	0.0	1.8	1.8	0.169	0.44	200	<0.028	0.67	757
39	PA92YK012	0.0	4.7	4.7	<0.028	0.52	319	<0.028	0.73	586
40	HA92YK 118	0.0	0.5	0.5	0.056	0.97	400	0.254	0.98	1495
41	HA92YK 117	0.0	0.9	0.9	<0.028	0.60	99	<0.028	0.38	121
42	HA92YK 119	0.0	1.4	1.4	<0.028	0.69	117	0.085	0.44	179
43	PA92YK013.1	0.0	4.0	4.0	<0.028	0.51	153	0.480	0.52	274
43	PA92YK013.2	4.0	5.5	5.5	<0.028	0.35	119	0.085	0.58	353
43	PA92YK013.3	5.5	7.3	1.8	<0.028	0.35	102	<0.028	0.44	237
43	PA92YK013.4	7.3	9.4	2.1	<0.028	0.30	86	<0.028	0.41	196
44	HA92YK 120	0.0	0.8	0.8	<0.028	0.75	123	<0.028	0.42	142
45	HA92YK 121	0.0	1.1	1.1	<0.028	0.82	134	<0.028	0.55	401
46	HA92YK 124	0.0	1.5	1.5	<0.028	0.83	168	0.790	0.80	798
47	HA92YK 123	0.0	0.8	0.8	<0.028	0.75	113	0.339	0.53	131
48	HA92YK 122	0.0	1.5	1.5	<0.028	0.78	109	<0.028	0.55	205
49	HA92YK 126	0.0	0.8	0.8	<0.028	0.91	114	<0.028	0.38	95
50	PA92YK014.1	0.0	2.1	2.1	<0.028	0.51	174	<0.028	0.56	511
50	PA92YK014.2	2.1	4.0	1.8	<0.028	0.51	131	<0.028	0.43	216
50	PA92YK014.3	4.0	5.8	1.8	<0.028	0.31	101	<0.028	0.46	174
51	HA92YK 125	0.0	0.8	0.8	<0.028	0.86	100	<0.028	0.50	138
52	HA92YK 127	0.0	1.4	1.4	<0.028	0.89	103	<0.028	0.52	187
53	CH92YK 128	0.0	2.1	2.1	<0.028	0.75	144	<0.028	0.62	344
54	PA92YK015.1	0.0	2.1	2.1	<0.028	0.51	117	<0.028	0.47	187
54	PA92YK015.2	2.1	4.0	1.8	<0.028	0.50	113	0.790	0.49	223
54	PA92YK015.3	4.0	5.8	1.8	0.056	0.33	105	<0.028	0.53	163

NA - Not analyzed

Appendix A. -- Map numbers, sample numbers, sampled intervals, and results of chemical analyses for head and spiral concentrate splits of eastern Gulf of Alaska samples

Map	Sample	Top	Bottom	Sampled	Head Splits			Spiral Concentrate Splits		
Number	Number	(m)	(m)	Interval (m)	Au (g/t)	Ti (pct)	Zr (ppm)	Au (g/t)	Ti (pct)	Zr (ppm)
54	PA92YK015.4	5.8	7.6	1.8	<0.028	0.28	82	<0.028	0.43	128
54	PA92YK015.5	7.6	9.4	1.8	<0.028	0.26	87	<0.028	0.40	146
55	HA92YK 129	0.0	0.8	0.8	<0.028	0.89	122	<0.028	0.53	278
56	HA92YK 130.1	0.0	1.5	1.5	<0.028	0.88	120	<0.028	0.57	250
56	HA92YK 130.2	1.5	3.0	1.5	<0.028	0.84	120	<0.028	0.54	227
57	HA92YK 131.1	0.0	1.2	1.2	<0.028	0.94	122	<0.028	0.53	235
57	HA92YK 131.2	1.2	2.1	0.9	<0.028	0.92	151	0.056	0.90	731
58	CH92YK 132	0.0	3.7	3.7	<0.028	0.84	164	0.085	0.73	778
59	CH92YK 135	0.0	1.5	1.5	<0.028	1.07	128	<0.028	0.61	1.44
60	CH92YK 134	0.0	0.8	0.8	<0.028	0.89	113	<0.028	0.52	301
61	CH92YK 133	0.0	1.1	1.1	NA	NA	NA	NA	NA	NA
62	PA92YK016.1	0.0	2.0	2.0	<0.028	0.56	163	0.536	0.68	608
62	PA92YK016.2	2.0	4.0	2.0	<0.028	0.44	121	0.085	0.43	222
62	PA92YK016.3	4.0	7.0	3.0	<0.028	0.28	97	0.282	0.46	181
62	PA92YK016.4	7.0	9.4	2.4	<0.028	0.27	91	<0.028	0.39	138
63	CH92YK 137.1	0.0	1.8	1.8	<0.028	0.86	134	0.056	0.59	370
63	CH92YK 137.2	0.0	1.5	1.5	<0.028	0.84	161	<0.028	0.71	553
64	HA92YK 136	0.0	1.2	1.2	<0.028	0.93	147	0.085	0.56	485
65	HA92YK 138	0.0	1.2	1.2	<0.028	0.93	111	<0.028	0.55	345
66	HA92YK 139	0.0	0.6	0.6	<0.028	0.88	116	0.056	0.54	316
67	PA92YK017.1	0.0	2.1	2.1	<0.028	0.47	113	<0.028	0.49	170
67	PA92YK017.2	2.1	4.0	1.8	<0.028	0.41	118	<0.028	0.37	119
67	PA92YK017.3	4.0	5.8	1.8	<0.028	0.28	81	<0.028	0.34	108
67	PA92YK017.4	5.8	7.6	1.8	<0.028	0.32	93	<0.028	0.37	122
67	PA92YK017.5	7.6	9.4	1.8	<0.028	0.30	97	0.198	0.44	165
68	HA92YK 141	0.0	1.2	1.2	<0.028	0.77	169	<0.028	0.67	650
69	HA92YK 140	0.0	0.9	0.9	<0.028	0.84	125	<0.028	0.58	423
70	HA92YK 142	0.0	1.1	1.1	<0.028	0.84	130	<0.028	0.50	299
71	PA92YK018.1	0.0	2.1	2.1	<0.028	0.41	124	<0.028	0.40	187
71	PA92YK018.2	2.1	4.0	1.8	0.056	0.42	117	<0.028	0.38	130
71	PA92YK018.3	4.0	5.8	1.8	<0.028	0.35	97	<0.028	0.37	135
71	PA92YK018.4	5.8	7.6	1.8	<0.028	0.34	147	<0.028	0.60	364
71	PA92YK018.5	7.6	9.4	1.8	<0.028	0.28	97	<0.028	0.49	217
72	HA92YK 145	0.0	0.9	0.9	0.056	0.75	142	0.169	0.79	949
73	HA92YK 144	0.0	0.9	0.9	<0.028	0.74	127	<0.028	0.62	287
74	HA92YK 143.1	0.0	1.5	1.5	<0.028	0.79	119	0.056	0.47	190
74	HA92YK 143.2	1.5	2.4	0.9	<0.028	0.82	109	<0.028	0.54	266
74	HA92YK 143.3	2.4	3.0	0.6	<0.028	0.83	122	<0.028	0.52	224
74	HA92YK 143.4	3.0	3.7	0.6	<0.028	0.71	138	<0.028	0.49	268
75	HA92YK 146	0.0	0.6	0.6	<0.028	0.65	124	0.085	0.38	156
76	HA92YK 147	0.0	0.9	0.9	<0.028	0.86	136	12.219	0.53	203
77	CH92YK 148	0.0	3.4	3.4	<0.028	0.81	153	0.198	0.76	759
78	PA92YK019.1	0.0	2.1	2.1	<0.028	0.45	104	<0.028	0.43	157
78	PA92YK019.2	2.1	4.0	1.8	<0.028	0.50	123	<0.028	0.60	251

NA - Not analyzed

Appendix A. -- Map numbers, sample numbers, sampled intervals, and results of chemical analyses for head and spiral concentrate splits of eastern Gulf of Alaska samples

Map	Sample	Top	Bottom	Sampled	Head Splits			Spiral Concentrate Splits		
Number	Number	(m)	(m)	Interval (m)	Au (g/t)	Ti (pct)	Zr (ppm)	Au (g/t)	Ti (pct)	Zr (ppm)
78	PA92YK019.3	4.0	5.2	1.2	<0.028	0.43	129	<0.028	0.40	162
79	PA92YK030	0.9	2.1	1.2	<0.028	0.47	151	<0.028	0.75	334
80	CH92YK029.1	0.0	1.5	1.5	0.056	0.47	161	0.339	1.00	620
80	CH92YK029.2	1.5	2.7	1.2	<0.028	0.43	111	<0.028	0.68	230
81	RS92YK 194	0.0	0.0	0.0	<0.028	0.88	150	0.085	0.84	476
82	HA92YK 150	0.0	0.6	0.6	<0.028	0.77	121	<0.028	0.44	168
83	HA92YK 149	0.0	0.6	0.6	<0.028	0.70	153	<0.028	1.01	1411
84	HA92YK 151	0.0	0.8	0.8	<0.028	0.79	128	<0.028	0.53	359
85	HA92YK 152	0.0	0.1	0.1	<0.028	0.77	139	<0.028	0.53	369
86	PA92YK028.1	0.0	2.1	2.1	<0.028	0.97	611	<0.028	2.08	2308
86	PA92YK028.2	2.1	4.0	1.8	<0.028	0.76	343	<0.028	1.62	1141
86	PA92YK028.3	4.0	5.8	1.8	<0.028	0.62	203	<0.028	1.14	549
86	PA92YK028.4	5.8	7.3	1.5	0.621	0.58	197	<0.028	1.06	522
87	CH92YK 155	0.0	1.8	1.8	<0.028	0.96	344	<0.028	1.52	1647
88	HA92YK 154	0.0	0.6	0.6	<0.028	0.78	132	<0.028	0.64	444
89	HA92YK 153	0.0	0.7	0.7	<0.028	0.77	136	<0.028	0.73	540
90	PA92YK020.1	0.0	1.8	1.8	<0.028	0.42	156	<0.028	0.47	459
90	PA92YK020.2	1.8	3.7	1.8	<0.028	0.32	96	<0.028	0.40	158
90	PA92YK020.3	3.7	5.5	1.8	<0.028	0.34	95	<0.028	0.36	112
91	PA92YK027.1	0.9	2.1	1.2	<0.028	1.76	1892	0.056	1.56	1268
91	PA92YK027.2	2.1	4.0	1.8	<0.028	0.73	747	<0.028	3.31	6041
91	PA92YK027.3	4.0	5.8	1.8	<0.028	1.27	1293	0.085	2.46	3728
92	HA92YK 157	0.0	1.2	1.2	<0.028	0.76	163	0.198	1.00	1113
93	HA92YK 156	0.0	0.6	0.6	<0.028	0.69	150	<0.028	0.72	561
94	PA92YK021.1	0.0	2.1	2.1	<0.028	0.48	173	<0.028	0.59	473
94	PA92YK021.2	2.1	4.0	1.8	<0.028	0.31	127	<0.028	0.40	260
94	PA92YK021.3	4.0	5.8	1.8	<0.028	0.28	92	0.085	0.39	148
95	HA92YK 158	0.0	0.6	0.6	<0.028	0.71	121	0.169	0.64	220
96	HA92YK 159	0.0	0.9	0.9	<0.028	0.73	122	0.790	0.67	276
97	HA92YK 160	0.0	0.5	0.5	<0.028	0.63	116	<0.028	0.57	287
98	HA92YK 161	0.0	0.3	0.3	<0.028	0.82	165	<0.028	1.04	611
99	CH92YK 162	0.0	2.1	2.1	<0.028	0.84	223	<0.028	1.62	1588
100	RS92YK 193	0.0	0.0	0.0	<0.028	0.80	181	0.339	0.78	1067
101	CH92YK 164	0.0	0.9	0.9	<0.028	1.00	333	<0.028	1.79	1993
102	HA92YK 163	0.0	0.3	0.3	<0.028	0.40	91	0.169	0.45	198
103	HA92YK 165	0.0	0.3	0.3	<0.028	0.62	117	0.056	0.37	124
104	CH92YK 166	0.0	1.5	1.5	<0.028	2.28	2038	<0.028	3.66	9209
105	HA92YK 167	0.0	0.3	0.3	0.056	0.40	85	<0.028	0.34	121
106	CH92YK 168.1	0.0	0.9	0.9	<0.028	1.64	794	<0.028	2.28	3686
106	CH92YK 168.2	0.9	1.8	0.9	<0.028	0.72	182	<0.028	1.18	888
106	CH92YK 168.3	1.8	2.7	0.9	<0.028	0.55	107	<0.028	0.54	174
107	PA92YK026.1	0.9	2.7	1.8	<0.028	0.72	371	<0.028	1.57	2312
107	PA92YK026.2	2.7	5.8	3.0	<0.028	0.50	326	0.056	1.17	1261
107	PA92YK026.3	5.8	6.7	0.9	0.056	0.40	236	0.141	0.86	751

NA - Not analyzed

Appendix A. -- Map numbers, sample numbers, sampled intervals, and results of chemical analyses for head and spiral concentrate splits of eastern Gulf of Alaska samples

Map	Sample	Top	Bottom	Sampled	Head Splits			Spiral Concentrate Splits		
Number	Number	(m)	(m)	Interval (m)	Au (g/t)	Ti (pct)	Zr (ppm)	Au (g/t)	Ti (pct)	Zr (ppm)
108	CH92YK 170.1	0.0	1.5	1.5	<0.028	2.12	1688	<0.028	2.85	6867
108	CH92YK 170.2	1.5	3.0	1.5	<0.028	0.68	163	<0.028	0.87	607
108	CH92YK 170.3	3.0	4.6	1.5	<0.028	0.46	119	<0.028	0.46	279
109	HA92YK 169	0.0	0.3	0.3	<0.028	0.42	79	<0.028	0.38	94
110	HA92YK 171	0.0	0.3	0.3	<0.028	0.76	198	<0.028	0.82	508
111	CH92YK 172	0.0	2.1	2.1	<0.028	0.56	169	<0.028	1.10	1105
112	RS92YK 192	0.0	0.0	0.0	<0.028	0.82	172	<0.028	0.83	733
113	CH92YK 174	0.0	2.1	2.1	<0.028	0.77	282	0.056	1.26	1475
114	HA92YK 173	0.0	0.6	0.6	<0.028	0.56	150	0.226	0.33	78
115	HA92YK 175	0.0	0.3	0.3	0.254	0.59	98	0.113	0.38	81
116	PA92YK022	0.0	2.1	2.1	<0.028	0.32	92	<0.028	0.43	92
117	HA92YK 176	0.0	0.6	0.6	<0.028	0.41	80	0.198	0.31	89
118	HA92YK 177	0.0	0.9	0.9	<0.028	0.62	121	<0.028	0.56	103
119	HA92YK 178.1	0.0	1.2	1.2	<0.028	0.85	156	<0.028	1.02	360
119	HA92YK 178.2	1.2	1.8	0.6	<0.028	0.80	111	<0.028	1.01	274
120	HA92YK 179	0.0	0.3	0.3	<0.028	0.72	87	<0.028	0.79	107
121	HA92YK 180	0.0	0.3	0.3	<0.028	1.29	134	<0.028	1.13	227
122	HA92YK 181	0.0	1.2	1.2	<0.028	1.53	261	<0.028	1.42	585
123	PA92YK023.1	0.0	2.1	2.1	<0.028	0.59	113	<0.028	0.99	205
123	PA92YK023.2	2.1	4.9	2.7	<0.028	0.39	98	<0.028	0.74	160
124	HA92YK 317	0.0	0.3	0.3	<0.028	0.82	96	<0.028	0.80	149
125	HA92YK 316	0.0	0.3	0.3	<0.028	0.50	72	<0.028	0.46	87
126	HA92YK 318	0.0	0.8	0.8	<0.028	1.09	225	<0.028	1.32	876
127	RS92YK 191	0.0	0.0	0.0	<0.028	0.85	182	<0.028	0.87	667
128	HA92YK 184	0.0	0.9	0.9	<0.028	1.06	192	<0.028	1.48	984
129	PA92YK024.1	0.0	2.1	2.1	<0.028	0.61	162	<0.028	1.39	649
129	PA92YK024.2	2.1	4.0	1.8	<0.028	0.34	83	<0.028	0.62	124
129	PA92YK024.3	4.0	5.8	1.8	<0.028	0.28	95	<0.028	0.55	151
129	PA92YK024.4	5.8	7.6	1.8	<0.028	0.26	69	<0.028	0.44	128
129	PA92YK024.5	7.6	9.6	2.0	<0.028	0.26	86	0.113	0.42	175
130	HA92YK 183	0.0	0.9	0.9	<0.028	0.89	85	<0.028	0.77	114
131	HA92YK 182	0.0	0.3	0.3	<0.028	0.65	91	<0.028	0.73	91
132	HA92YK 313	0.0	0.3	0.3	<0.028	0.43	77	<0.028	0.40	80
133	HA92YK 314	0.0	0.8	0.8	<0.028	0.67	84	<0.028	0.58	102
134	HA92YK 315	0.0	0.9	0.9	<0.028	1.11	233	0.056	1.33	969
135	HA93GA 079	2.4	3.7	1.2	<0.028	0.50	174	0.028	0.49	304
136	HA92YK 312	0.0	0.8	0.8	<0.028	1.50	515	<0.028	2.06	2154
137	HA92YK 311	0.0	0.3	0.3	<0.028	0.57	84	0.085	0.58	158
138	HA92YK 310	0.0	0.3	0.3	<0.028	0.46	91	<0.028	0.38	102
139	PA92YK025.1	0.0	2.1	2.1	0.056	0.80	453	<0.028	1.91	1841
139	PA92YK025.2	2.1	4.0	1.8	<0.028	0.50	213	<0.028	1.38	912
139	PA92YK025.3	4.0	5.8	1.8	<0.028	0.35	135	<0.028	0.81	457
139	PA92YK025.4	5.8	7.2	1.4	<0.028	0.30	100	0.339	0.59	256
140	HA92YK 309	0.0	0.3	0.3	<0.028	0.57	114	<0.028	0.53	164

NA - Not analyzed

Appendix A. -- Map numbers, sample numbers, sampled intervals, and results of chemical analyses for head and spiral concentrate splits of eastern Gulf of Alaska samples

Map	Sample	Top	Bottom	Sampled	Head Splits			Spiral Concentrate Splits		
Number	Number	(m)	(m)	Interval (m)	Au (g/t)	Ti (pct)	Zr (ppm)	Au (g/t)	Ti (pct)	Zr (ppm)
141	HA92YK 308	0.0	0.9	0.9	<0.028	0.55	94	<0.028	0.59	228
142	HA92YK 307	0.0	0.9	0.9	0.056	1.27	530	<0.028	1.94	2593
143	RS92YK 190	0.0	0.0	0.0	<0.028	0.40	146	<0.028	0.71	284
144	HA92YK 304	0.0	1.2	1.2	<0.028	1.26	564	<0.028	2.22	3674
145	HA92YK 305	0.0	0.8	0.8	<0.028	0.68	118	<0.028	0.92	445
146	HA92YK 306	0.0	0.6	0.6	<0.028	0.59	99	<0.028	0.55	210
147	HA92YK 303	0.0	0.3	0.3	<0.028	0.64	102	<0.028	0.49	150
148	HA92YK 302	0.0	1.7	1.7	<0.028	0.76	126	<0.028	0.94	477
149	HA92YK 301	0.0	0.9	0.9	<0.028	0.69	170	0.226	0.93	418
150	RS92YK 189	0.0	0.0	0.0	<0.028	0.83	171	<0.028	0.90	547
151	RS92YK 188	0.0	0.0	0.0	<0.028	0.85	206	<0.028	0.95	663
152	CH92YK 187	0.0	4.6	4.6	<0.028	0.96	136	<0.028	0.52	230
153	HA92YK 185	0.0	0.3	0.3	<0.028	0.89	153	1.552	1.49	1630
153	HA92YK 186	0.0	1.2	1.2	<0.028	0.94	153	0.452	1.10	695
154	HA93GA 080	0.0	1.5	1.5	<0.028	0.49	115	0.056	1.07	331
155	HA93GA 081	0.0	1.4	1.4	<0.028	0.34	104	<0.028	0.53	119
156	HA93GA 082	0.0	1.5	1.5	<0.028	0.64	123	0.169	2.27	516
157	GR93GA 083	0.0	0.2	0.2	<0.028	0.38	112	<0.028	1.55	389
158	HA93GA 066	0.0	1.4	1.4	<0.028	0.41	122	<0.028	1.39	351
159	CH93GA 065	0.0	2.4	2.4	<0.028	0.36	111	0.056	0.58	133
160	GR93GA 064	0.0	0.1	0.1	<0.028	0.38	140	<0.028	0.53	144
161	HA93GA 063	0.0	0.6	0.6	<0.028	0.43	108	<0.028	1.37	206
162	GR93GA 062	0.0	0.1	0.1	<0.028	0.44	154	<0.028	1.48	857
163	CH92YA 887	0.0	0.9	0.9	<0.028	0.47	130	<0.028	0.88	327
164	HA92YA 891.1	0.0	1.2	1.2	<0.028	0.67	161	0.056	2.59	953
164	HA92YA 891.2	1.2	2.1	0.9	<0.028	0.43	102	<0.028	1.43	281
164	HA92YA 891.3	2.1	2.7	0.6	<0.028	0.37	103	<0.028	1.15	242
165	HA92YA 890.1	0.0	1.2	1.2	<0.028	0.73	130	<0.028	1.61	231
165	HA92YA 890.2	1.2	1.7	0.5	<0.028	0.49	104	<0.028	1.44	231
166	HA92YA 879.1	0.0	1.2	1.2	<0.028	0.50	111	<0.028	1.65	1287
166	HA92YA 879.2	1.2	2.3	1.1	0.198	0.58	129	<0.028	1.82	319
167	HA92YA 880	0.0	0.6	0.6	0.056	0.46	107	<0.028	1.46	234
168	HA92YA 875.1	0.0	1.2	1.2	0.056	0.79	187	<0.028	2.34	756
168	HA92YA 875.2	1.2	2.4	1.2	<0.028	0.95	187	<0.028	2.48	801
168	HA92YA 875.3	2.4	2.7	0.3	<0.028	0.66	120	<0.028	2.25	587
169	HA92YA 876.1	0.0	1.2	1.2	0.056	0.56	111	<0.028	1.79	266
169	HA92YA 876.2	1.2	1.5	0.3	<0.028	0.49	105	0.085	1.22	148
170	HA92YA 877.1	0.0	1.2	1.2	<0.028	0.79	155	0.085	2.39	547
170	HA92YA 877.2	1.2	2.1	0.9	<0.028	0.58	124	0.085	2.19	521
171	HA92YA 878.1	0.0	1.2	1.2	<0.028	0.39	103	<0.028	1.31	232
171	HA92YA 878.2	1.2	1.5	0.3	<0.028	0.32	95	<0.028	1.04	194
172	HA92YA 872	0.0	1.4	1.4	<0.028	0.55	115	<0.028	1.18	157
173	HA92YA 873	0.0	0.6	0.6	<0.028	0.33	100	<0.028	0.95	153
174	HA92YA 874	0.0	0.3	0.3	0.056	0.44	116	<0.028	1.19	521

NA - Not analyzed

Appendix A. -- Map numbers, sample numbers, sampled intervals, and results of chemical analyses for head and spiral concentrate splits of eastern Gulf of Alaska samples

Map Number	Sample Number	Top (m)	Bottom (m)	Sampled Interval (m)	Head Splits			Spiral Concentrate Splits		
					Au (g/t)	Ti (pct)	Zr (ppm)	Au (g/t)	Ti (pct)	Zr (ppm)
175	HA92YA 870	0.0	0.3	0.3	<0.028	0.38	104	<0.028	1.06	32
176	CH92YA 871.1	0.0	1.2	1.2	0.028	0.33	102	<0.028	0.92	249
176	CH92YA 871.2	1.2	2.4	1.2	0.056	0.40	109	0.141	0.69	164
177	HA92YA 881	0.0	0.6	0.6	<0.028	0.47	104	<0.028	1.42	260
178	HA92YA 882	0.0	0.6	0.6	<0.028	0.45	117	0.141	1.40	325
179	HA92YA 883.1	0.0	1.2	1.2	<0.028	0.64	122	<0.028	2.21	530
179	HA92YA 883.2	1.2	2.4	1.2	<0.028	0.42	94	<0.028	1.33	116
180	HA92YA 885	0.0	0.6	0.6	<0.028	0.59	108	<0.028	1.40	165
181	HA92YA 884	0.0	0.5	0.5	<0.028	0.51	113	<0.028	1.38	256
182	HA92YA 824	0.0	1.2	1.2	<0.028	0.71	114	<0.028	1.45	210
183	HA92YA 825	0.0	0.3	0.3	<0.028	0.40	114	<0.028	0.87	110
184	HA92YA 826	0.0	0.3	0.3	2.145	0.40	110	<0.028	0.93	128
185	HA92YA 823	0.0	0.9	0.9	0.028	0.67	101	<0.028	1.25	151
186	HA92YA 822	0.0	0.5	0.5	<0.028	0.43	104	<0.028	0.79	111
187	HA92YA 821	0.0	0.2	0.2	<0.028	0.43	96	<0.028	0.78	114
188	HA92YA 819	0.0	0.3	0.3	<0.028	1.01	127	<0.028	1.48	196
189	PA92YA 706	0.0	1.9	1.9	<0.028	1.53	227	0.056	3.09	642
190	PA92YA 705.1	0.0	1.5	1.5	<0.028	3.86	1676	<0.028	5.05	1007
190	PA92YA 705.2	1.5	3.4	1.8	<0.028	0.79	218	<0.028	3.03	977
190	PA92YA 705.3	3.4	5.2	1.8	<0.028	0.97	271	<0.028	2.92	997
190	PA92YA 705.4	5.2	7.0	1.8	<0.028	0.44	115	<0.028	0.97	265
190	PA92YA 705.5	7.0	9.8	2.7	<0.028	0.53	150	<0.028	1.72	510
191	HA92YA 820	0.0	0.1	0.1	<0.028	4.54	1624	<0.028	6.03	2944
192	HA92YA 817.1	0.0	1.2	1.2	<0.028	2.76	723	0.141	4.80	2116
192	HA92YA 817.2	1.2	1.7	0.5	<0.028	2.37	546	<0.028	3.81	1510
193	HA92YA 818.1	0.0	1.2	1.2	<0.028	0.70	115	<0.028	1.53	190
193	HA92YA 818.2	1.2	2.0	0.8	<0.028	1.18	155	<0.028	2.24	366
194	HA92YA 816	0.0	0.9	0.9	<0.028	0.53	98	0.959	1.08	144
195	HA92YA 815.1	0.0	1.2	1.2	<0.028	3.11	961	<0.028	4.93	2290
195	HA92YA 815.2	1.2	2.1	0.9	<0.028	1.25	267	<0.028	3.95	1431
196	PA92YA 704.1	0.0	1.8	1.8	<0.028	1.18	160	<0.028	1.92	322
196	PA92YA 704.2	1.8	3.7	1.8	<0.028	0.43	125	<0.028	0.96	143
196	PA92YA 704.3	3.7	5.5	1.8	<0.028	0.40	107	<0.028	0.77	129
196	PA92YA 704.4	5.5	7.3	1.8	<0.028	0.39	107	<0.028	0.68	129
196	PA92YA 704.5	7.3	9.1	1.8	<0.028	0.40	92	<0.028	0.85	140
197	HA92YA 812.1	0.0	1.2	1.2	<0.028	2.04	450	<0.028	3.84	1547
197	HA92YA 812.2	1.2	2.3	1.1	<0.028	1.36	223	<0.028	2.85	739
198	HA92YA 813	0.0	0.3	0.3	<0.028	0.40	93	<0.028	0.83	136
199	HA92YA 814	0.0	0.3	0.3	<0.028	0.42	100	<0.028	0.85	142
200	HA92YA 811	0.0	0.3	0.3	<0.028	0.40	105	<0.028	0.71	105
201	HA92YA 810	0.0	0.6	0.6	<0.028	0.46	109	0.169	0.95	171
202	HA92YA 809.1	0.0	1.2	1.2	<0.028	1.82	465	<0.028	3.68	1351
202	HA92YA 809.2	1.2	2.1	0.9	<0.028	2.16	523	<0.028	3.81	1560
203	PA92YA 703.1	0.0	1.8	1.8	<0.028	1.15	154	<0.028	1.87	311

NA - Not analyzed

Appendix A. -- Map numbers, sample numbers, sampled intervals, and results of chemical analyses for head and spiral concentrate splits of eastern Gulf of Alaska samples

Map	Sample	Top	Bottom	Sampled	Head Splits			Spiral Concentrate Splits		
Number	Number	(m)	(m)	Interval (m)	Au (g/t)	Ti (pct)	Zr (ppm)	Au (g/t)	Ti (pct)	Zr (ppm)
203	PA92YA 703.2	1.8	5.5	3.7	<0.028	0.46	117	<0.028	1.45	289
203	PA92YA 703.3	5.5	7.6	2.1	<0.028	0.39	91	<0.028	0.84	150
203	PA92YA 703.4	7.6	9.8	2.1	<0.028	0.40	112	<0.028	0.68	160
204	HA92YA 886.1	0.0	1.2	1.2	<0.028	0.56	119	0.056	1.58	374
204	HA92YA 886.2	1.2	2.4	1.2	0.028	0.60	129	<0.028	1.60	478
204	HA92YA 886.3	2.4	3.7	1.2	<0.028	0.65	123	<0.028	1.79	602
204	HA92YA 886.4	3.7	4.9	1.2	<0.028	0.57	130	<0.028	1.76	436
204	HA92YA 886.5	4.9	6.1	1.2	<0.028	0.67	164	0.085	1.87	515
205	HA92YA 806.1	0.0	1.2	1.2	<0.028	3.06	1267	<0.028	5.18	2876
205	HA92YA 806.2	1.2	2.1	0.9	<0.028	3.08	886	<0.028	4.38	1685
206	HA92YA 807	0.0	1.2	1.2	<0.028	0.84	118	<0.028	1.36	194
207	HA92YA 808	0.0	0.3	0.3	0.367	0.34	81	<0.028	0.62	100
208	PA92YA 702.1	0.0	1.2	1.2	<0.028	0.33	90	<0.028	0.53	93
208	PA92YA 702.2	1.2	3.0	1.8	<0.028	0.38	100	<0.028	0.72	124
208	PA92YA 702.3	3.0	6.7	3.7	<0.028	0.36	100	<0.028	0.64	153
208	PA92YA 702.4	6.7	9.8	3.0	<0.028	0.37	116	<0.028	0.66	197
209	HA92YA 804	0.0	0.3	0.3	<0.028	0.48	100	<0.028	0.94	147
210	HA92YA 805	0.0	0.5	0.5	<0.028	0.32	90	<0.028	0.56	94
211	HA92YA 803.1	0.0	1.2	1.2	<0.028	1.62	409	<0.028	3.32	1440
211	HA92YA 803.2	1.2	2.1	0.9	<0.028	2.50	600	<0.028	5.71	2346
212	HA92YA 801.1	0.0	1.2	1.2	<0.028	3.25	1284	<0.028	4.68	2698
212	HA92YA 801.2	1.2	2.4	1.2	<0.028	1.96	529	<0.028	4.85	2860
213	PA92YA 802	0.0	1.1	1.1	<0.028	2.93	1182	<0.028	3.29	1411
214	HA92YA 828.1	0.0	1.2	1.2	0.169	0.82	116	<0.028	1.61	253
214	HA92YA 828.2	1.2	2.3	1.1	<0.028	0.80	147	<0.028	1.80	364
215	PA92YA 701.1	0.0	2.1	2.1	<0.028	1.78	499	<0.028	4.49	1562
215	PA92YA 701.2	2.1	4.0	1.8	<0.028	0.53	154	<0.028	1.84	499
215	PA92YA 701.3	4.0	5.8	1.8	<0.028	0.46	119	0.141	1.60	393
215	PA92YA 701.4	5.8	7.3	1.5	<0.028	0.38	111	<0.028	1.02	237
215	PA92YA 701.5	7.3	9.1	1.8	<0.028	0.37	102	<0.028	1.02	243
215	PA92YA 701.6	9.1	11.0	1.8	<0.028	0.40	110	<0.028	1.30	346
216	HA92YA 827.1	0.0	1.2	1.2	<0.028	3.31	1353	<0.028	5.54	3142
216	HA92YA 827.2	1.2	2.1	0.9	<0.028	2.75	1188	<0.028	6.27	3722
217	HA92YA 849	0.0	0.1	0.1	<0.028	4.59	3287	<0.028	5.68	4156
218	HA92YA 831	0.0	0.9	0.9	<0.028	0.37	106	<0.028	0.80	102
219	HA92YA 830.1	0.0	1.2	1.2	<0.028	0.50	113	<0.028	1.11	178
219	HA92YA 830.2	1.2	1.5	0.3	<0.028	0.62	100	0.056	1.15	142
220	HA92YA 829.1	0.0	1.2	1.2	0.056	2.75	1048	<0.028	4.73	2576
220	HA92YA 829.2	1.2	2.1	0.9	<0.028	2.81	1082	<0.028	5.40	3016
221	PA92YA 707.1	0.0	1.8	1.8	<0.028	2.36	751	<0.028	4.17	1831
221	PA92YA 707.2	1.8	3.4	1.5	<0.028	0.77	200	0.141	2.69	918
221	PA92YA 707.3	3.4	6.7	3.4	<0.028	0.45	128	<0.028	1.79	530
221	PA92YA 707.4	6.7	9.4	2.7	<0.028	0.40	95	<0.028	1.03	240
222	HA92YA 832.1	0.0	1.2	1.2	<0.028	1.74	420	<0.028	3.11	1172

NA - Not analyzed

Appendix A. -- Map numbers, sample numbers, sampled intervals, and results of chemical analyses for head and spiral concentrate splits of eastern Gulf of Alaska samples

Map	Sample	Top	Bottom	Sampled	Head Splits			Spiral Concentrate Splits		
Number	Number	(m)	(m)	Interval (m)	Au (g/t)	Ti (pct)	Zr (ppm)	Au (g/t)	Ti (pct)	Zr (ppm)
222	HA92YA 832.2	1.2	2.1	0.9	<0.028	1.76	334	<0.028	3.15	852
223	HA92YA 833	0.0	0.9	0.9	<0.028	0.58	117	<0.028	1.17	200
224	HA92YA 834.1	0.0	1.2	1.2	<0.028	1.79	404	<0.028	3.23	1335
224	HA92YA 834.2	1.2	1.5	0.3	0.028	2.01	466	<0.028	3.80	1365
225	HA92YA 835	0.0	0.8	0.8	<0.028	0.50	157	<0.028	1.16	176
226	HA92YA 836	0.0	0.6	0.6	0.056	0.42	182	<0.028	0.82	116
227	HA92YA 856.1	0.0	1.2	1.2	<0.028	1.13	229	<0.028	2.77	953
227	HA92YA 856.2	1.2	2.4	1.2	<0.028	0.96	199	<0.028	2.55	910
227	HA92YA 856.3	2.4	3.7	1.2	<0.028	1.67	506	<0.028	4.54	2536
228	PA92YA 708.1	0.0	1.8	1.8	<0.028	2.49	803	<0.028	4.38	1969
228	PA92YA 708.2	1.8	3.7	1.8	<0.028	0.65	148	<0.028	2.70	765
228	PA92YA 708.3	3.7	7.3	3.7	<0.028	0.48	129	<0.028	1.72	434
228	PA92YA 708.4	7.3	9.8	2.4	<0.028	0.43	116	<0.028	1.64	439
229	HA92YA 838.1	0.0	1.2	1.2	<0.028	0.50	112	<0.028	1.46	272
229	HA92YA 838.2	1.2	1.5	0.3	<0.028	0.40	106	<0.028	1.14	190
230	HA92YA 839	0.0	0.2	0.2	<0.028	0.45	107	<0.028	0.90	123
231	HA92YA 837.1	0.0	1.2	1.2	<0.028	2.15	455	<0.028	3.74	1576
231	HA92YA 837.2	1.2	1.8	0.6	0.028	1.54	241	<0.028	2.92	734
232	HA92YA 854	0.0	0.8	0.8	<0.028	1.83	538	<0.028	3.81	2054
233	HA92YA 855.1	0.0	1.2	1.2	<0.028	1.14	243	<0.028	3.24	1398
233	HA92YA 855.2	1.2	2.1	0.9	<0.028	1.00	213	<0.028	3.00	1310
233	HA92YA 855.3	2.1	3.2	1.1	<0.028	1.42	392	<0.028	3.96	2236
233	HA92YA 855.4	3.2	4.6	1.4	0.085	1.39	372	0.056	3.79	2282
233	HA92YA 855.5	4.6	5.8	1.2	<0.028	1.17	257	<0.028	3.14	1373
233	HA92YA 855.6	5.8	6.1	0.3	<0.028	1.18	240	0.169	3.15	1406
234	HA92YA 853.1	0.0	1.2	1.2	<0.028	1.64	488	<0.028	3.56	1871
234	HA92YA 853.2	1.2	1.5	0.3	<0.028	1.40	394	<0.028	3.63	1823
235	HA92YA 840.1	0.0	1.2	1.2	<0.028	2.25	545	<0.028	4.35	1816
235	HA92YA 840.2	1.2	1.5	0.3	<0.028	1.85	289	<0.028	3.35	864
236	HA92YA 841.1	0.0	1.2	1.2	<0.028	0.48	108	<0.028	1.21	190
236	HA92YA 841.2	1.2	1.4	0.2	<0.028	0.37	96	<0.028	0.98	145
237	HA92YA 843.1	0.0	1.2	1.2	<0.028	0.67	140	<0.028	2.00	479
237	HA92YA 843.2	1.2	2.3	1.1	<0.028	0.61	135	<0.028	1.86	446
238	HA92YA 844	0.0	0.3	0.3	<0.028	0.29	103	<0.028	0.61	106
239	HA92YA 842.1	0.0	1.2	1.2	<0.028	1.70	389	<0.028	4.03	1634
239	HA92YA 842.2	1.2	1.7	0.5	<0.028	1.29	303	<0.028	3.29	1126
240	HA92YA 852.1	0.0	1.2	1.2	<0.028	1.82	519	<0.028	4.01	1992
240	HA92YA 852.2	1.2	2.1	0.9	<0.028	1.96	655	<0.028	4.26	2657
240	HA92YA 852.3	2.1	2.4	0.3	<0.028	1.73	556	<0.028	4.31	2242
241	PA92YA 711.1	0.0	1.8	1.8	<0.028	1.26	319	<0.028	2.85	1183
241	PA92YA 711.2	1.8	3.7	1.8	<0.028	1.03	196	<0.028	2.66	779
241	PA92YA 711.3	3.7	5.5	1.8	<0.028	0.59	138	<0.028	1.78	409
241	PA92YA 711.4	5.5	7.3	1.8	<0.028	0.46	115	<0.028	0.82	198
241	PA92YA 711.5	7.3	9.4	2.1	<0.028	0.45	104	<0.028	0.86	226

NA - Not analyzed

Appendix A. -- Map numbers, sample numbers, sampled intervals, and results of chemical analyses for head and spiral concentrate splits of eastern Gulf of Alaska samples

Map	Sample	Top	Bottom	Sampled	Head Splits			Spiral Concentrate Splits		
Number	Number	(m)	(m)	Interval (m)	Au (g/t)	Ti (pct)	Zr (ppm)	Au (g/t)	Ti (pct)	Zr (ppm)
242	PA92YA 713.1	0.0	1.8	1.8	<0.028	0.82	184	<0.028	2.17	800
242	PA92YA 713.2	1.8	5.5	3.7	<0.028	0.43	131	<0.028	1.38	328
242	PA92YA 713.3	5.5	8.5	3.0	<0.028	0.40	102	<0.028	1.09	195
243	PA92YA 714.1	0.0	1.8	1.8	<0.028	0.63	140	0.085	1.92	557
243	PA92YA 714.2	1.8	5.5	3.7	<0.028	0.56	120	0.028	1.54	394
243	PA92YA 714.3	5.5	9.4	4.0	<0.028	0.38	106	<0.028	0.99	231
244	PA92YA 715.1	0.0	1.8	1.8	<0.028	0.83	187	<0.028	2.22	872
244	PA92YA 715.2	1.8	5.5	3.7	<0.028	0.80	151	<0.028	1.85	434
244	PA92YA 715.3	5.5	9.8	4.3	<0.028	0.50	124	0.028	1.38	296
245	PA92YA 712.1	0.0	1.8	1.8	<0.028	0.82	202	<0.028	2.24	797
245	PA92YA 712.2	1.8	3.7	1.8	<0.028	0.52	117	<0.028	1.35	310
245	PA92YA 712.3	3.7	5.5	1.8	<0.028	0.48	108	<0.028	1.46	179
245	PA92YA 712.4	5.5	7.3	1.8	<0.028	0.43	115	<0.028	1.14	233
245	PA92YA 712.5	7.3	9.4	2.1	<0.028	0.40	115	<0.028	1.00	347
246	HA92YA 851	0.0	0.8	0.8	<0.028	1.55	426	<0.028	3.92	2157
247	HA92YA 845.1	0.0	1.2	1.2	<0.028	1.65	379	0.056	3.66	1487
247	HA92YA 845.2	1.2	2.1	0.9	0.028	1.01	224	<0.028	3.62	1342
248	HA92YA 846.1	0.0	1.2	1.2	0.028	0.55	130	<0.028	2.06	491
248	HA92YA 846.2	1.2	2.1	0.9	<0.028	0.44	104	<0.028	1.56	331
249	PA92YA 710.1	0.0	1.8	1.8	0.028	1.05	176	<0.028	2.56	503
249	PA92YA 710.2	1.8	5.5	3.7	<0.028	0.44	112	0.056	1.26	235
249	PA92YA 710.3	5.5	9.4	4.0	<0.028	0.45	96	<0.028	1.38	281
250	PA92YA 709.1	0.0	1.8	1.8	<0.028	1.43	303	<0.028	2.94	756
250	PA92YA 709.2	1.8	5.5	3.7	<0.028	0.55	128	<0.028	1.68	346
250	PA92YA 709.3	5.5	7.3	1.8	<0.028	0.41	105	<0.028	1.16	234
250	PA92YA 709.4	7.3	9.4	2.1	<0.028	0.45	128	<0.028	1.24	266
251	HA92YA 848.1	0.0	1.2	1.2	<0.028	1.36	267	<0.028	3.07	1154
251	HA92YA 848.2	1.2	2.1	0.9	<0.028	0.80	153	<0.028	2.21	548
252	CH92YA 847.1	0.0	1.2	1.2	0.028	0.93	212	<0.028	2.92	1136
252	CH92YA 847.2	1.2	2.4	1.2	<0.028	1.07	287	<0.028	3.10	1240
252	CH92YA 847.3	2.4	3.7	1.2	0.085	1.12	279	<0.028	3.26	1320
252	CH92YA 847.4	3.7	4.9	1.2	<0.028	0.80	203	<0.028	3.07	1081
253	CH92YA 850.1	0.0	1.2	1.2	<0.028	1.25	330	0.028	2.94	1475
253	CH92YA 850.2	1.2	2.4	1.2	<0.028	1.12	274	<0.028	2.83	1194
253	CH92YA 850.3	2.4	3.7	1.2	0.028	2.16	749	0.113	4.64	2617
253	CH92YA 850.4	3.7	4.4	0.8	<0.028	2.14	747	<0.028	4.55	2609
254	HA92YA 857.1	0.0	1.2	1.2	<0.028	2.04	567	<0.028	4.46	2134
254	HA92YA 857.2	1.2	2.4	1.2	<0.028	1.06	251	<0.028	3.65	1459
254	HA92YA 857.3	2.4	3.0	0.6	0.028	0.92	201	<0.028	4.01	1596
255	HA92YA 858	0.0	0.9	0.9	<0.028	0.81	159	<0.028	2.33	632
256	HA92YA 859.1	0.0	1.2	1.2	<0.028	0.94	205	<0.028	2.90	912
256	HA92YA 859.2	1.2	2.1	0.9	<0.028	0.58	157	<0.028	2.45	632
257	HA92YA 860	0.0	0.2	0.2	<0.028	0.36	100	<0.028	1.04	218
258	PA92YA 716.1	0.0	1.8	1.8	<0.028	0.46	113	<0.028	1.42	292

NA - Not analyzed

Appendix A. -- Map numbers, sample numbers, sampled intervals, and results of chemical analyses for head and spiral concentrate splits of eastern Gulf of Alaska samples

Map Number	Sample Number	Top (m)	Bottom (m)	Sampled Interval (m)	Head Splits			Spiral Concentrate Splits		
					Au (g/t)	Ti (pct)	Zr (ppm)	Au (g/t)	Ti (pct)	Zr (ppm)
258	PA92YA 716.2	1.8	3.7	1.8	<0.028	0.45	113	<0.028	1.36	300
258	PA92YA 716.3	3.7	5.5	1.8	<0.028	0.46	116	<0.028	1.50	384
258	PA92YA 716.4	5.5	7.3	1.8	<0.028	0.41	125	<0.028	1.19	260
258	PA92YA 716.5	7.3	9.4	2.1	<0.028	0.37	105	<0.028	1.04	240
259	HA92YA 861.1	0.0	1.2	1.2	<0.028	2.60	851	<0.028	5.67	2820
259	HA92YA 861.2	1.2	2.3	1.1	<0.028	1.77	411	<0.028	5.29	2300
259	HA92YA 861.3	2.3	2.7	0.5	<0.028	1.18	236	<0.028	4.77	1868
260	HA92YA 862.1	0.0	1.2	1.2	<0.028	2.21	637	<0.028	5.32	2472
260	HA92YA 862.2	1.2	2.4	1.2	<0.028	1.42	306	<0.028	4.32	1776
260	HA92YA 862.3	2.4	2.7	0.3	<0.028	1.21	300	0.141	4.23	1468
261	HA92YA 863.1	0.0	1.2	1.2	<0.028	0.92	183	<0.028	3.18	937
261	HA92YA 863.2	1.2	2.4	1.2	<0.028	0.64	151	<0.028	2.54	707
262	HA92YA 864	0.0	0.1	0.1	<0.028	0.47	119	<0.028	1.55	288
263	HA92YA 869	0.0	0.2	0.2	<0.028	0.83	130	<0.028	1.58	258
264	HA92YA 868.1	0.0	1.2	1.2	<0.028	0.74	119	0.056	1.86	289
264	HA92YA 868.2	1.2	2.1	0.9	<0.028	0.54	126	0.028	1.56	258
265	HA92YA 867.1	0.0	1.2	1.2	0.226	1.68	396	<0.028	4.82	1898
265	HA92YA 867.2	1.2	2.4	1.2	<0.028	1.17	297	0.339	4.22	1732
265	HA92YA 867.3	2.4	3.4	0.9	0.056	1.43	323	0.113	4.22	1668
266	CH92YA 865.1	0.0	1.8	1.8	<0.028	2.07	698	0.198	4.72	2900
266	CH92YA 865.2	1.8	3.2	1.4	<0.028	1.29	186	<0.028	3.60	1602
266	CH92YA 865.3	3.2	4.4	1.2	<0.028	2.26	522	<0.028	4.01	1392
266	CH92YA 865.4	4.4	5.5	1.1	<0.028	0.73	121	<0.028	1.78	323
267	CH92YA 866	0.0	0.3	0.3	1.298	4.05	2534	0.113	4.86	3032
268	PA92YA 717.1	0.0	1.8	1.8	<0.028	1.15	340	<0.028	3.34	1250
268	PA92YA 717.2	1.8	3.7	1.8	0.028	0.45	147	<0.028	1.19	325
268	PA92YA 717.3	3.7	5.5	1.8	<0.028	0.43	110	<0.028	0.94	206
268	PA92YA 717.4	5.5	7.3	1.8	<0.028	0.52	151	<0.028	1.42	358
268	PA92YA 717.5	7.3	9.4	2.1	<0.028	0.44	135	<0.028	1.15	245
269	HA93GA 059.1	0.0	0.9	0.9	<0.028	0.45	163	<0.028	0.68	282
269	HA93GA 059.2	0.9	2.1	1.2	<0.028	0.44	126	0.310	0.69	255
270	HA93GA 061	0.0	1.5	1.5	<0.028	0.41	134	<0.028	0.64	285
271	GR93GA 057	0.0	0.1	0.1	<0.028	0.40	137	<0.028	0.94	241
272	RS93GA 058	0.0	0.1	0.1	<0.028	0.39	151	<0.028	0.46	161
273	RS93GA 060	0.0	0.2	0.2	<0.028	0.43	163	0.169	1.53	482
274	HA93GA 068	0.0	1.8	1.8	<0.028	NA	NA	<0.028	0.53	316
275	GR93GA 049	0.0	0.1	0.1	<0.028	0.58	183	<0.028	0.76	281
275	HA93GA 069	0.0	0.6	0.6	<0.028	0.46	178	0.056	0.76	318
276	CH93GA 045	0.0	1.2	1.2	<0.028	NA	NA	<0.028	0.63	180
277	HA93GA 046	0.0	0.9	0.9	<0.028	1.01	286	0.028	3.20	1665
278	HA93GA 044	0.0	1.4	1.4	<0.028	0.47	132	0.310	1.80	725
279	HA93GA 050	0.0	0.6	0.6	<0.028	0.38	137	<0.028	1.09	443
280	HA93GA 047	0.0	0.6	0.6	<0.028	0.50	126	0.254	1.39	404
281	HA93GA 048	0.0	1.2	1.2	0.056	0.58	110	<0.028	2.01	535

NA - Not analyzed

Appendix A. -- Map numbers, sample numbers, sampled intervals, and results of chemical analyses for head and spiral concentrate splits of eastern Gulf of Alaska samples

Map	Sample	Top	Bottom	Sampled	Head Splits			Spiral Concentrate Splits		
Number	Number	(m)	(m)	Interval (m)	Au (g/t)	Ti (pct)	Zr (ppm)	Au (g/t)	Ti (pct)	Zr (ppm)
282	HA93GA 067	0.0	1.7	1.7	<0.028	0.48	163	<0.028	0.89	373
283	HA93GA 042	0.0	1.2	1.2	<0.028	0.49	127	0.818	1.68	470
283	HA93GA 043	0.0	1.2	1.2	<0.028	0.46	106	0.056	1.89	526
284	HA93GA 052	0.9	1.5	0.6	<0.028	0.65	127	<0.028	1.31	333
285	HA93GA 051.1	0.0	1.5	1.5	<0.028	0.81	165	<0.028	2.89	1081
285	HA93GA 051.2	1.5	2.8	1.4	<0.028	0.82	163	<0.028	2.35	953
285	HA93GA 051.3	2.8	4.4	1.5	<0.028	0.79	154	0.113	1.92	724
285	HA93GA 051.4	4.4	4.7	0.3	<0.028	0.79	165	0.282	1.77	572
286	HA93GA 041	0.0	0.9	0.9	<0.028	0.80	170	<0.028	3.23	1292
287	HA93GA 039.1	0.0	1.7	1.7	<0.028	0.89	156	0.508	3.47	1055
287	HA93GA 039.2	1.7	2.9	1.2	<0.028	0.89	162	0.085	3.77	1210
288	HA93GA 053	0.0	1.1	1.1	<0.028	0.63	226	<0.028	0.80	292
289	RS93GA 054	0.0	0.2	0.2	<0.028	0.39	150	<0.028	0.98	256
289	PC93GA 055	0.0	0.1	0.1	<0.028	NA	NA	<0.028	0.77	197
290	HA93GA 040	0.0	0.6	0.6	<0.028	0.97	165	0.818	3.02	278
291	CH93GA 030	0.0	1.5	1.5	<0.028	0.63	132	<0.028	3.21	873
291	HA93GA 031	0.0	0.9	0.9	<0.028	0.47	98	0.056	1.64	281
292	HA93GA 038.1	0.0	1.8	1.8	<0.028	0.56	115	0.085	2.15	462
292	HA93GA 038.2	1.8	3.4	1.6	<0.028	0.66	140	0.056	2.75	634
293	HA93GA 056.1	0.0	1.8	1.8	<0.028	0.57	109	0.085	1.58	339
293	HA93GA 056.2	1.8	3.5	1.7	<0.028	0.52	92	<0.028	1.27	245
294	HA93GA 037.1	0.0	2.3	2.3	<0.028	0.41	92	<0.028	1.68	211
294	HA93GA 037.2	2.3	3.2	0.9	<0.028	0.47	86	0.113	1.62	181
294	HA93GA 037.3	3.2	4.3	1.1	<0.028	0.50	86	<0.028	1.77	233
295	HA93GA 034	0.0	2.4	2.4	<0.028	0.71	90	0.339	2.66	257
296	CH93GA 035	0.0	0.9	0.9	<0.028	0.65	81	<0.028	2.77	276
297	GR93GA 036	0.0	0.5	0.5	<0.028	0.37	93	<0.028	0.92	88
298	HA93GA 032.1	0.0	1.9	1.9	<0.028	0.88	111	0.028	3.84	323
298	HA93GA 032.2	1.9	3.4	1.5	<0.028	0.76	86	<0.028	3.35	264
298	HA93GA 033	0.0	0.6	0.6	<0.028	0.52	72	0.056	1.52	120
299	CH93GA 029.1	0.0	2.4	2.4	<0.028	0.90	98	0.169	5.14	392
299	CH93GA 029.2	2.4	4.9	2.4	<0.028	0.82	99	-0.028	4.57	336
300	HA93GA 028	0.0	1.8	1.8	<0.028	1.00	91	-0.028	3.14	264
301	CH93GA 027	0.0	0.6	0.6	<0.028	0.84	85	0.564	4.09	186
302	GR93GA 024	0.0	0.1	0.1	<0.028	0.75	78	<0.028	3.78	176
303	HA93GA 023.1	0.0	1.8	1.8	0.056	0.95	73	0.649	4.56	162
303	HA93GA 023.2	1.8	3.7	1.8	<0.028	1.34	82	0.085	4.89	212
304	GR93GA 013	0.0	0.1	0.1	<0.028	0.59	102	<0.028	1.09	138
305	HA93GA 025	0.0	1.2	1.2	<0.028	0.42	101	0.028	0.67	106
305	RK93GA 026	0.9	1.2	0.3	<0.028	0.49	156	<0.028	0.68	295
306	CH93GA 022	0.0	2.1	2.1	<0.028	1.54	87	0.028	6.26	250
307	HA93GA 021	0.0	1.5	1.5	0.339	4.37	145	0.169	10.48	308
308	HA93GA 011	0.0	0.3	0.3	<0.028	3.61	117	<0.028	7.05	176
308	HG93GA 012	0.0	0.1	0.1	<0.028	5.41	180	<0.028	8.66	270

NA - Not analyzed

Appendix A. -- Map numbers, sample numbers, sampled intervals, and results of chemical analyses for head and spiral concentrate splits of eastern Gulf of Alaska samples

Map	Sample	Top	Bottom	Sampled	Head Splits			Spiral Concentrate Splits		
Number	Number	(m)	(m)	Interval (m)	Au (g/t)	Ti (pct)	Zr (ppm)	Au (g/t)	Ti (pct)	Zr (ppm)
309	HA93GA 020.1	0.0	2.1	2.1	<0.028	0.71	90	0.028	4.18	125
309	HA93GA 020.2	2.1	4.1	2.0	<0.028	0.55	87	<0.028	1.66	130
310	CH93GA 010	0.0	2.4	2.4	0.113	0.73	73	0.395	2.49	107
311	HA93GA 008	0.0	1.7	1.7	<0.028	0.55	75	<0.028	2.02	105
311	HA93GA 009	0.0	1.5	1.5	<0.028	0.47	81	<0.028	1.26	83
312	CH93GA 018	0.0	9.1	9.1	<0.028	0.44	150	<0.028	0.56	202
313	PC93GA 016	0.0	0.2	0.2	<0.028	NA	NA	0.028	0.79	59
314	GR93GA 003	0.0	0.1	0.1	<0.028	1.30	43	<0.028	3.20	73
315	HA93GA 006.1	0.0	1.4	1.4	<0.028	2.00	61	0.113	7.29	87
315	HA93GA 006.2	1.4	2.5	1.1	<0.028	2.57	54	<0.028	9.98	128
315	HA93GA 006.3	2.5	3.0	0.5	<0.028	2.60	61	0.085	9.65	140
315	PC93GA 007	0.0	0.1	0.1	<0.028	NA	NA	<0.028	14.88	150
316	GR93GA 001	0.0	0.1	0.1	<0.028	1.10	59	0.198	3.12	88
317	HA93GA 002	0.0	0.8	0.8	<0.028	0.44	52	<0.028	1.22	54
318	HA93GA 004.1	0.0	1.5	1.5	<0.028	2.04	56	<0.028	3.49	63
318	HA93GA 004.2	1.5	2.7	1.2	<0.028	2.22	39	<0.028	4.43	90
318	HA93GA 004.3	2.7	4.0	1.2	<0.028	1.85	51	<0.028	4.02	78
319	GR93GA 015	0.0	0.1	0.1	<0.028	4.95	720	<0.028	6.15	1084

NA - Not analyzed

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	Gross	Tare	Net	+10 Mesh	-10 Mesh	Gross	Tare	Archive	Head	Spiral	Flotation	Total	+10 Mesh	-10 Mesh	Conc.	Reject	Total	Assay	ALRC	Total
PA92YK 001.1	12417.4	46	12371.4	7661.8	4709.6	5714	1668	466	62	2988	528	4044		2988	307.8	2673.6	2981.4	37.6	270.3	307.9
PA92YK 001.2	59735.1	1117.1	58618	30283.1	28334.9	26946	3086	2926	458	17428	3020	23832		17428	1678.9	15644.8	17323.7	203.2	1475.5	1678.7
PA92YK 002.1	23116.3	562.6	22553.7	6634.3	15919.4	14970	1602	1640	238	9838	1672	13388	195.5	9642.5	819.8	8806.1	9625.9	100.5	719.3	819.8
PA92YK 002.2	26654.1	563.1	26091	8985.7	17105.3	16026	1630	1774	300	10340	1920	14334		10340	876.6	9457.1	10333.7	105.5	770.5	876
PA92YK 003.1	21521.7	563	20958.7	9971	10987.7	10704	1554	1042	164	6762	1182	9150		6762	683.4	6054.8	6738.2	88	595.2	683.2
PA92YK 003.2	11884.8	50	11834.8	5644.2	6190.6	6698	1556	632	80	3710	706	5128		3710	455.9	3232.9	3688.8	57.4	398.4	455.8
PA92YK 004.1	14256.4	564	13692.4	528	13164.4	12294	1530	1318	218	7800	1428	10764		7800	1110.7	6683.3	7794	138.5	972.2	1110.7
PA92YK 004.2	12854.1	559	12295.1	2087.5	10207.6	9744	1536	1008	170	6000	1034	8212		6000	897	5015.2	5912.2	113.7	783.3	897
PA92YK 005	8304	555.5	7748.5	572.3	7176.2	6419.3	529.2	645.6	93.1	4364.7	618.3	5721.7		4364.7	640.9	3698.8	4339.7	78	562.8	640.8
PA92YK 006.1	16725.1	563	16162.1	5165.1	10997	10816	1552	1108	204	6770	1180	9262		6770	1068.2	5678	6746.2	128	940.2	1068.2
PA92YK 006.2	4569.5	50.6	4518.9	1827.8	2691.1	3286	1006	270	40	1670	300	2280		1670	191.3	1333.8	1525.1	24.5	166.8	191.3
PA92YK 007	9374.1	51.2	9322.9	760.1	8562.8	8312	1006	738	108	5542	918	7306		5542	649.6	4869.4	5519	79.9	569.7	649.6
PA92YK 008.1	10779.7	50	10729.7	7771.4	2958.3	3226	694	244	34	1950	302	2530		1950	181.8	1760.5	1942.3	21.6	159.8	181.4
PA92YK 008.2	10234.9	52.4	10182.5	6203	3979.5	4134	682	354	54	2654	394	3456		2654	313.9	2322.7	2636.6	38.2	275.7	313.9
PA92YK 008.3	6138.2	51.9	6086.3	1866	4220.3	4254	648	360	48	2770	430	3608		2770	373.9	2392.3	2766.2	45.5	328.7	374.2
PA92YK 008.4	6787.7	51	6736.7	1100.7	5636	5832	1056	472	72	3658	576	4778		3658	399.2	3249.4	3648.6	50.4	348.9	399.3
PA92YK 008.5	5844.9	52.7	5792.2	1278.6	4513.6	4498	694	372	56	2910	468	3806		2910	330.7	2570.5	2901.2	42.4	288.4	330.8
PA92YK 008.6	12446.5	559.9	11886.6	1952.4	9934.2	9684	1544	944	158	5978	1052	8132		5978	577	5324.4	5901.4	70.4	506.6	577
PA92YK 008.7	17571.2	562.9	17008.3	1808.8	15199.5	14304	1824	1540	262	9054	1626	12482		9054	906.5	8123.1	9029.6	113.8	792.4	906.2
PA92YK 009.1	12022.8	45.8	11977	2968.6	9008.4	9770	1980	952	154	5652	1034	7792		5652	468.9	5185.7	5654.6	59.4	409.5	468.9
PA92YK 009.2	9226	555.7	8670.3	267.3	8403	8410.2	1292.1	777.8	111.9	5379.4	794.7	7063.8		5379.4	734.5	4619.9	5354.4	90.5	644.6	735.1
PA92YK 009.3	9954	569.3	9384.7	240.8	9143.9	8639.3	1008.1	810.1	117.5	5793.4	817.6	7538.6		5793.4	1184	4561	5745	141.1	1043.2	1184.3
PA92YK 009.4	11322	562	10760	1500.9	9259.1	8315.3	1014.7	783.7	112.3	5513.2	777.7	7186.9		5513.2	1065.6	3980	5045.6	133.2	932.1	1065.3
PA92YK 009.5	11950	558	11392	814.2	10577.8	9393	1149.1	900.3	130	6323.3	882.5	8236.1		6323.3	511.2	5775.7	6286.9	42.4	457.4	499.8
CH92YK 010	70508	2239.1	68268.9	11288.6	56980.3	56686	4648	6292	1144	44526	NONE	51962		44526	4715.7	38966.7	43682.4	596.5	4119.5	4716
PA92YK 012	29220	1225.4	27994.6	4045.6	23949	19108	2041.3	1875.8	271.2	12482	1761.7	16390.7		12482	4708.8	7706.9	12415.7	574.1	4133.5	4707.6
PA92YK 013.1	9858	561.8	9296.2	3856.8	5439.4	6159.9	1007.9	569	82.7	3945.9	556.1	5153.7		3945.9	601.8	3340.6	3942.4	74.8	526.7	601.5
PA92YK 013.2	10374	555.6	9818.4	1673.2	8145.2	8194.1	1291.1	757.9	109.1	4816.7	699.6	6383.3		4816.7	714.6	4040.1	4754.7	87.2	627.7	714.9
PA92YK 013.3	9924	554.8	9369.2	2171.3	7197.9	6008.5	523.5	592.6	82.5	4155.7	577.2	5408		4155.7	557.5	3579	4136.5	77	496.6	573.6
PA92YK 013.4	8416	567.3	7848.7	905.1	6943.6	6371	1041.6	590.7	81.3	4061.7	597.1	5330.8		4061.7	578.8	3453.7	4032.5	73.3	505.3	578.6
PA92YK 014.1	9760	568.9	9191.1	2941.5	6249.6	6311.2	831.3	604.7	84.9	4192.9	588.4	5470.9		4192.9	676.6	3503.3	4179.9	87.9	594.7	682.6
PA92YK 014.2	8390	569.5	7820.5	1772	6048.5	6024.7	913.1	567.2	80.3	3904.1	560.9	5112.5		3904.1	361.1	3536.1	3897.2	43.4	318.1	361.5
PA92YK 014.3	11434	562.6	10871.4	592.2	10279.2	9246.5	979.3	890.7	124.6	6359.9	914.3	8289.5		6359.9	1008.8	5275.7	6284.5	125.1	883.8	1008.9
PA92YK 015.1	4692	566.9	4125.1	629	3496.1	4226.1	1005.3	353.5	46.9	2388	338.8	3127.2		2388	230	2148.3	2378.3	28.7	200.7	229.4

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	Gross	Tare	Net	+10 Mesh	-10 Mesh	Gross	Tare	Archive	Head	Spiral	Flotation	Total	+10 Mesh	-10 Mesh	Conc.	Reject	Total	Assay	ALRC	Total
PA92YK 015.2	5640	558.6	5081.4	1214.5	3866.9	4600.1	931.1	405.7	52.6	795.9	114.8	1369		795.9	119.7	661.5	781.2	14.6	105	119.6
PA92YK 015.3	12110	565.3	11544.7	514.6	11030.1	9752.1	1002	914.9	134	6731.3	957.7	8737.9		6731.3	853.1	5804	6657.1	105.5	746.9	852.4
PA92YK 015.4	12510	567.5	11942.5	436.5	11506	10437.6	1217.2	1052.2	147.3	6755.5	959.9	8914.9		6755.5	1298.9	5396	6694.9	159.5	1139.9	1299.4
PA92YK 015.5	13876	567.2	13308.8	332.4	12976.4	10732.4	1002.1	1077.8	149.1	7433.8	1062	9722.7		7433.8	1387.7	6032.2	7419.9	175	1213.1	1388.1
PA92YK 016.1	7392	559.5	6832.5	914.4	5918.1	5932.4	931.9	528.1	76.5	3829.2	565.6	4999.4		3829.2	395.9	3391.9	3787.8	49.4	357.7	407.1
PA92YK 016.2	6034	559.3	5474.7	1832.4	3642.3	3414.8	1005.7	248.3	36.7	1858.6	264.5	2408.1		1858.6	357.6	1498.3	1855.9	44.6	312.8	357.4
PA92YK 016.3	10130	560.3	9569.7	1915.2	7654.5	7074.8	1217.5	629.6	89.6	4365.8	638.9	5723.9		4365.8	655.1	3682.7	4337.8	81.4	574.1	655.5
PA92YK 016.4	12300	566.1	11733.9	1425.2	10308.7	8590.1	979.4	829.9	117.9	5851.5	808.9	7608.2		5851.5	1067.8	4767.4	5835.2	131.4	936.7	1068.1
PA92YK 017.1	7340	557.9	6782.1	2724.2	4057.9	4346.6	1005.6	366.3	50.8	2566.5	356.5	3340.1		2566.5	182.9	2374.9	2557.8	22.5	160.4	182.9
PA92YK 017.2	6902	564	6338	2720	3618	3443.1	523.3	316.4	44.7	2235.5	322.8	2919.4		2235.5	379.4	1842.7	2222.1	48.7	330.2	378.9
PA92YK 017.3	10578	558.3	10019.7	1446.3	8573.4	7968.2	1005.4	761.9	108.4	5331.7	762.2	6964.2		5331.7	529.4	4781.8	5311.2	62.3	465.9	528.2
PA92YK 017.4	11422	556.9	10865.1	2277.9	8587.2	8018.2	979.5	783.7	113.7	5331.3	771.5	7000.2		5331.3	817.8	4469.4	5287.2	103.5	726	829.5
PA92YK 017.5	12264	562.2	11701.8	1745.3	9956.5	9496	1217.5	898.4	126.7	6179.2	895.7	8100		6179.2	1130.1	5009.6	6139.7	134.5	1005.9	1140.4
PA92YK 018.1	7686	557.8	7128.2	4086.8	3041.4	3928	931.6	327	45.8	2292.2	329.2	2994.2		2292.2	295.9	1985.7	2281.6	37.1	258.9	296
PA92YK 018.2	4882	607.1	4274.9	1815.4	2459.5	2841.5	1001.6	203.8	28.5	1406.1	200.5	1838.9		1406.1	174.3	1224	1398.3	22.3	151.8	174.1
PA92YK 018.3	7710	559.3	7150.7	2424.1	4726.6	4574.1	913.2	399.7	56.5	2795.9	408.9	3661		2795.9	466.6	2329.9	2796.5	60.2	406.7	466.9
PA92YK 018.4	10406	561	9845	1735	8110	7229.6	831.1	682.5	98.7	4917.5	699.5	6398.2		4917.5	891.6	4017.9	4909.5	111.5	779.9	891.4
P92YK 018.5	11586	557.8	11028.2	1161.4	9866.8	8870.1	1041.1	857.3	122.5	5982.5	866.3	7828.6		5982.5	811.7	5127.9	5939.6	101.9	710.2	812.1
PA92YK 019.1	6862	561.9	6300.1	2650.4	3649.7	3744.3	1291.1	268.1	38.2	1875.1	269.3	2450.7		1875.1	153.1	1720.9	1874	19.3	133.6	152.9
PA92YK 019.2	6800	558.5	6241.5	2804.9	3436.6	3397.8	1002	255.8	35.8	1843	261.2	2395.8		1843	141.9	1696.2	1838.1	18.4	123.5	141.9
PA92YK 019.3	5678	561.1	5116.9	1625.7	3491.2	3604.5	931.7	294.5	41.9	1995.7	291.5	2623.6		1995.7	201.8	1784.8	1986.6	25.2	176.7	201.9
PA92YK 020.1	5018	560.4	4457.6	1883.1	2574.5	3193.1	1291.3	207.2	31.3	1453.2	208.3	1900		1453.2	102.3	1328.6	1430.9	12.9	89	101.9
PA92YK 020.2	8270	556.6	7713.4	2066.1	5647.3	5592.4	1041.4	504.5	71.4	3473.6	499.3	4548.8		3473.6	584.2	2885.7	3469.9	74.5	509.3	583.8
PA92YK 020.3	9392	556.9	8835.1	2060.1	6775	6412.7	830.9	590.1	82.6	4266.1	636.1	5574.9		4266.1	701	3555.1	4256.1	89.7	610.2	699.9
PA92YK 021.1	5648	564.6	5083.4	1673.8	3409.6	3556.6	931.5	284.7	41.4	2011.2	287.9	2625.2		2011.2	388.6	1664.6	2053.2	42	296.3	338.3
PA92YK 021.2	10350	556.9	9793.1	1105.2	8687.9	7904.6	1002.4	772.7	108.9	5267.8	751	6900.4		5267.8	1118.1	4143.2	5261.3	136.3	979.3	1115.6
PA92YK 021.3	11138	560.8	10577.2	468.9	10108.3	9043.7	1218.1	869	128.9	4537.5	639.7	6175.1		4537.5	743.4	3779.4	4522.8	93.2	649.4	742.6
PA92YK 022	10990	553.1	10436.9	2255.2	8181.7	7849.4	1005.8	750.5	108.8	5242.7	744.1	6846.1		5242.7	1007.8	4228.6	5236.4	125.6	881.9	1007.5
P92YK 023.1	11766	558.3	11207.7	26.8	11180.9	10863.5	1668.3	1008	146.7	6194.4	872.1	8221.2		6194.4	1725.8	4459.7	6185.5	214.5	1510.9	1725.4
PA92YK 023.2	15948	554.6	15393.4	3004	12389.4	11658.2	1461.5	1102.4	154.2	7809.6	1124.2	10190.4		7809.6	1103.5	6692.2	7795.7	135.2	968.4	1103.6
PA92YK 024.1	9560	552.2	9007.8		9007.8	8141.1	830.7	797.7	114.1	5595.5	801.4	7308.7		5595.5	847.8	4717.5	5565.3	104.5	743.2	847.7
PA92YK 024.2	12256	557.9	11698.1	4.2	11693.9	11841.7	2332.9	1054.4	152.9	7280.8	1022.2	9510.3		7280.8	1086.9	6183.6	7270.5	134.4	952.7	1087.1
PA92YK 024.3	10724	559.2	10164.8	108.2	10056.6	9414.1	1304.6	889.9	129.9	6211	881.3	8112.1		6211	1085.8	5105.7	6191.5	129.7	956.8	1086.5
PA92YK 024.4	11356	561.4	10794.6	284.9	10509.7	10014	1515.3	947.9	132.8	6503.3	912.7	8496.7		6503.3	1187.1	5303.9	6491	146.4	1040.4	1186.8

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	Gross	Tare	Net	+10 Mesh	-10 Mesh	Gross	Tare	Archive	Head	Spiral	Flotation	Total	+10 Mesh	-10 Mesh	Conc.	Reject	Total	Assay	ALRC	Total
PA92YK 024.5	11600	559.4	11040.6	124.5	10916.1	10253.4	1455.5	954.8	130.9	6727.6	978.5	8791.8		6727.6	1154.2	5554.6	6708.8	148.1	1004.4	1152.5
PA92YK 025.1	10602	558.4	10043.6	4.9	10038.7	9886	1668.1	893.6	124.6	6339.4	868	8225.6		6339.4	1191.5	5133.2	6324.7	153.2	1035.7	1188.9
PA92YK 025.2	10026	558.5	9467.5	639	8828.5	8238	1005.2	803.4	117.5	5452.3	799.1	7172.3		5452.3	807.2	4642.4	5449.6	102.4	704.8	807.2
PA92YK 025.3	11438	567.9	10870.1	1003.8	9866.3	9488.7	1216.9	877.5	127.3	6303.3	910.5	8218.6		6303.3	1060.7	5236	6296.7	133.3	923.3	1056.6
PA92YK 025.4	6598	556.6	6041.4	285.3	5756.1	5086.4	523.2	503.7	71.6	3505.5	482.2	4563		3505.5	567.8	2927.2	3495	73.6	492.9	566.5
PA92YK 026.1	9132	563.1	8568.9	193.3	8375.6	6480.4	1041.3	582.8	82.2	4172.3	585.7	5423		4172.3	879.9	3123.1	4003	108.6	770	878.6
PA92YK 026.2	5162	553.6	4608.4	16.2	4592.2	4975.8	1291.2	403.4	57.7	2817.8	405	3683.9		2817.8	510.9	2303.8	2814.7	62.8	448.5	511.3
PA92YK 026.3	5616	554.4	5061.6	242.1	4819.5	4862.7	1001.9	419.5	61	2953.8	424	3858.3		2953.8	507.7	2436.5	2944.2	62	444.6	506.6
PA92YK 027.1	5860	554.5	5305.5	55.9	5249.6	2578.7	685.6	216.1	31.7	1430.1	206	1883.9		1430.1	246.3	1136.2	1382.5	30.9	214.4	245.3
PA92YK 027.2	8432	563.6	7868.4	19.7	7848.7	6498.3	830.9	633.6	86.7	4343.5	603.9	5667.7		4343.5	1037	3266.7	4303.7	129.6	906.4	1036
PA92YK 027.3	3380	554.3	2825.7	59.2	2766.5	2231.6	NONE	241.1	35.2	1678.6	277.2	2232.1		1678.6	422.6	1229.3	1651.9	52.9	369.2	422.1
PA92YK 028.1	5156	556.5	4599.5	27.3	4572.2	3659.6	NONE	398	57.7	2744.5	459.6	3659.8		2744.5	562	2174.9	2736.9	68.7	492.9	561.6
PA92YK 028.2	7194	551.5	6642.5	234	6408.5	6385.3	1038.5	564.1	83	4030.1	667.4	5344.6		4030.1	821.2	3195.5	4016.7	101.4	718.8	820.2
PA92YK 028.3	10728	555.7	10172.3	2213.3	7959	7558.1	902.4	744.1	101.8	4954.5	851.7	6652.1		4954.5	825.7	4119.8	4945.5	106.4	719.5	825.9
PA92YK 028.4	10582	556	10026	3007.7	7018.3	7203.4	1288.4	654.2	91.5	4419.8	741.6	5907.1		4419.8	884.8	3532.4	4417.2	111.5	773.2	884.7
CH92YK 029.1	28928	1114.6	27813.4	9988.3	17825.1	17121.6	0	1831.8	263.9	12861.1	2145.5	17102.3		12861.1	1412.4	11303.1	12715.5	176.1	1236.1	1412.2
CH92YK 029.2	28216	1105.3	27110.7	15830.7	11280	12792.7	1913.3	1185.8	170.1	8157.1	1346.4	10859.4		8157.1	946	7167.3	8113.3	121.8	823.3	945.1
PA92YK 030	5634	552.7	5081.3	1824.4	3256.9	3505.4	523	332.6	45.7	2211.5	389.3	2979.1		2211.5	501.2	1498.5	1999.7	60.8	439.2	500
PA92YK 031.1	7862	549.8	7312.2	14.5	7297.7	7960.3	999.1	757.3	104.5	5234.7	864	6960.5		5234.7	1146.7	4054.7	5201.4	147.8	998.2	1146
PA92YK 031.2	5686	560.9	5125.1	0	5125.1	6119.8	1214.2	541	80.6	3678.9	603.4	4903.9		3678.9	415	3262.4	3677.4	52.5	362.5	415
PA92YK 031.3	5932	559.9	5372.1	0	5372.1	6358.4	1288.5	547.7	77.7	3818.8	624.8	5069		3818.8	927.4	2886.3	3813.7	119.5	807.3	926.8
PA92YK 031.4	5864	552.5	5311.5	0	5311.5	6099.6	1038.1	559.4	79	3781.9	636.2	5056.5		3781.9	534.1	3239.3	3773.4	65	469.1	534.1
PA92YK 031.5	5010	551.6	4458.4	0	4458.4	5068.7	827.9	474.8	68.2	3158	539.7	4240.7		3158	687.1	2463.8	3150.9	86.4	599.9	686.3
PA92YK 032.1	7914	553.5	7360.5	985.8	6374.7	5924.8	910.7	545.1	78.9	3776	612.4	5012.4		3776	505.3	3263	3768.3	63.9	440.5	504.4
PA92YK 032.2	8560	552.4	8007.6	1561.2	6446.4	6122.6	1037.9	555.6	79.7	3825.1	622.4	5082.8		3825.1	667.2	3149.9	3817.1	79.2	586.4	665.6
PA92YK 032.3	5928	553.7	5374.3	1738.3	3636	3713.4	928.8	304.1	44.2	2090.7	344.7	2783.7		2090.7	273.4	1810.5	2083.9	32.3	240.5	272.8
HA92YK 101	30785.5	555.8	30229.7	17668.3	12561.4	9572.1	1197	924.6	131.4	6276.8	1040.3	8373.1	0	6276.8	631.1	7158.5	7789.6	79.2	552.6	631.8
HA92YK 102	28824.4	552.9	28271.5	10896.4	17375.1			1385.5	198.8	9558.1	1596.3	12738.7	0	9558.1	1452.4	8075.1	9527.5	184.3	1268.3	1452.6
HA92YK 103	MISSING	1125.8	-1125.8	1067.9	-2193.7			2410.7	344	16591.4	2761.2	22107.3	0	16591.4	2113	14959.2	17072.2	268.6	1839.5	2108.1
HA92YK 104	MISSING	557.9	-557.9	127.4	-685.3			766.4	109.8	5322.9	874.9	7074	0	5322.9	690.8	4634.1	5324.9	84.7	606	690.7
HA92YK 105	MISSING	553.1	-553.1	5312.7	-5865.8	5316.7	828.7	483.7	69	3365.3	565.5	4483.5	0	3365.3	617.6	2800.4	3418	74.4	543.4	617.8
HA92YK 106	16402	554.8	15847.2		15847.2	17772	2388	1490	200	11732	1888	15310	5939.6	5792.4	457	5396.4	5853.4	59.8	397.2	457
HA92YK 107.1	11128	557.3	10570.7	792.9	9777.8	11584.9	2752	1030	156	6280	1388	8854	792.9	5487.1	456.2	5199.9	5656.1	56.9	399.3	456.2
HA92YK 107.2	12348	550.2	11797.8		11797.8	12331.1	1304.1	1270	192	8238	1338	11038	74.6	8163.4	1202.7	6959.6	8162.3	150.8	1051.8	1202.6

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	**Gross**	**Tare**	**Net**	**+10 Mesh**	**-10 Mesh**	**Gross**	**Tare**	**Archive**	**Head**	**Spiral**	**Flotation**	**Total**	**+10 Mesh**	**-10 Mesh**	**Conc.**	**Reject**	**Total**	**Assay**	**ALRC**	**Total**
HA92YK 107.3	5596	557.9	5038.1	119.2	4918.9	4821.8	698	472	82	2896	682	4132	119.2	2776.8	584.1	2231	2815.1	72.7	511.7	584.4
HA92YK 108	7908	552.8	7355.2		7355.2	8570.8	1906	764	68	4972	862	6666	3004.8	1967.2	441.2	1571.9	2013.1	54.8	386	440.8
HA92YK 109	12346	553.5	11792.5		11792.5	13295	2752	1228	158	7990	1162	10538	3868.3	4121.7	1019.3	3185.3	4204.6	127.2	891.8	1019
CH92YK 111	46751.3	1129.5	45621.8	22791.2	22830.6	21076	2033.5	2266	306	13978	2500	19050	421.4	13556.6	1283	12320	13603	163.5	1119.3	1282.8
HA92YK 112	21722	1229.6	20492.4		20492.4	18582	1937.2	1828	258	12350	2164	16600	35	12315	1269.6	10940.4	12210	155.5	1113.3	1268.8
CH92YK 113	25388	1103.5	24284.5	15204	9080.5	26648	2751.8	2268	272	16740	4590	23870	10715.7	6024.3	746.9	5591.7	6338.6	95.7	650.5	746.2
HA92YK 114	33240.8	47	33193.8	27239	5954.8	6731.4	1668	520	92	3760	692	5064	0	3760	450.3	3303.5	3753.8	55.4	395	450.4
HA92YK 115	43356.2	551.4	42804.8	33734.7	9070.1	8240.8	697.8	922	100	5583	929	7534	386.5	5196.5	395.5	4845.4	5240.9	48	347.2	395.2
HA92YK 116	19430	1132	18298		18298	18348	2390.6	1834	262	11752	2096	15944	541.2	11210.8	787.5	10599.8	11387.3	95.9	690.9	786.8
HA92YK 117	29657.1	556.1	29101	19065.3	10035.7	9965.6	1600	1004	176	6110	1076	8366	0	6110	841.4	5257.8	6099.2	105.2	734.7	839.9
HA92YK 118	27503	568.7	26934.3	18808.5	8125.8	8154.1	1306.4	788	100	5062	888	6838	452.3	4609.7	897.6	3748.6	4646.2	112.3	785.2	897.5
HA92YK 119	31196.7	555.9	30640.8	12718.7	17922.1	16808.1	1544	1680	268	11468	1846	15262	0	11468	1005	10439.4	11444.4	123.8	880.7	1004.5
HA92YK 120	25422.4	555.8	24866.6	12540.2	12326.4	11825.4	1556	1150	222	7650	1244	10266	0	7650	465.2	7147.3	7612.5	58.3	406.7	465
HA92YK 121	23914.8	553.3	23361.5	5518.8	17842.7	16756	1554	1802	256	11284	1848	15190	0	11284	759.5	10518	11277.5	92.9	666.2	759.1
HA92YK 122	26406	1109.7	25296.3	0	25296.3	25906	1632	2878	410	17746	3224	24258	5609	12137	966.4	11637.5	12603.9	121.4	844.2	965.6
HA92YK 123	12852	1123.5	11728.5		11728.5	12744	1530	1316	208	8300	1386	11210	986.3	7313.7	662.8	6681.6	7344.4	83.9	578.5	662.4
HA92YK 124	22396	1125.6	21270.4		21270.4	22096	1544	2338	318	15288	2576	20520	1549.9	13738.1	1189.8	12591.9	13781.7	148.2	1040.8	1189
HA92YK 125	15080	1125.4	13954.6		13954.6	14978	1530	1438	214	10034	1748	13434	1716.7	8317.3	562.7	7966.9	8529.6	71.7	490.7	562.4
HA92YK 126	21536	1123.2	20412.8		20412.8	21476	1556	2180	344	14874	2498	19896	7617.5	7256.5	427.5	7201.6	7629.1	52.5	369.9	422.4
HA92YK 127	33014	1113.6	31900.4		31900.4	33934	3136	3412	546	22984	3834	30776	7356.4	15627.6	1207.2	14977	16184.2	151.7	1055.1	1206.8
CH92YK 128	34154	1105.5	33048.5	1951.8	31096.7	33950	3104	3536	530	22714	4052	30832	1951.8	20762.2	2540.6	18321.9	20862.5	325.4	2215.2	2540.6
HA92YK 129	18747	554.3	18192.7	1963	16229.7	14670	698	1730	262	10200	1774	13966	561.9	9638.1	672.8	9003.7	9676.5	85.4	586.9	672.3
HA92YK 130.1	21786	1113	20673		20673	21474	1554	2286	380	14658	2572	19896	831.8	13826.2	973.3	12876.2	13849.5	118.6	854.4	973
HA92YK 130.2	32256	1111.1	31144.9		31144.9	33476	3204	3488	444	22336	3984	30252	3418.2	18917.8	1178.3	18129.4	19307.7	143.6	1034.7	1178.3
HA92YK 131.1	31696	1121.7	30574.3		30574.3	30806	3084	3054	396	20478	3740	27668	3428.8	17049.2	1741.7	15300.7	17042.4	219.3	1522.4	1741.7
HA92YK 131.2	34310	1116.3	33193.7		33193.7	35670	3358	3318	552	24326	4084	32280	3315.7	21010.3	1293.6	19951.7	21245.3	156.8	1136	1292.8
CH92YK 132	26400	1114.7	25285.3	2110.8	23174.5	27558	3184	2666	454	18182	3050	24352	2110.8	16071.2	1361.5	14826.3	16187.8	167.1	1194.4	1361.5
HA92YK 133	32543.4	1116.6	31426.8	11339.4	20087.4	-	-	SAMPLE #133 AND #134 COMBINED					-	-	-	-	-	-	-	-
HA92YK 134	20944	1115.5	19828.5		19828.5	20966	3086	3958	672	27416	4686	36732	8665.9	18750.1	821.8	18470.2	19292	106.2	715.6	821.8
CH92YK 135	8904	547.6	8356.4	431.3	7925.1	7080	1666	594	82	4044	676	5396	431.3	3612.7	74.2	3757.1	3831.3	9.6	64.6	74.2
HA92YK 136	31564	1088.6	30475.4		30475.4	32812	3524	1926	312	25092	2004	29334	8917.5	16174.5	958.4	15628.5	16586.9	119.2	839.2	958.4
CH92YK 137.1	12890	542	12348	1128.6	11219.4	13098	1304	1238	238	8812	1498	11786	1128.6	7683.4	673.6	7070.8	7744.4	83.2	590.3	673.5
CH92YK 137.2	37914	1632	36282	5715.6	30566.4	38474	3450	3638	548	26606	4192	34984	5715.6	20890.4	1724.8	19379.9	21104.7	213	1511.4	1724.4
HA92YK 138	29886	1084.8	28801.2		28801.2	28902	1900	3008	520	20224	3230	26982	3108.8	17115.2	750.4	16477.9	17228.3	93.2	657.2	750.4

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	**Gross**	**Tare**	**Net**	**+10 Mesh**	**-10 Mesh**	**Gross**	**Tare**	**Archive**	**Head**	**Spiral**	**Flotation**	**Total**	**+10 Mesh**	**-10 Mesh**	**Conc.**	**Reject**	**Total**	**Assay**	**ALRC**	**Total**
HA92YK 139	23596	1240.8	22355.2		22355.2	23250	1600	2396	324	16276	2624	21620	3010.3	13265.7	643	12838.6	13481.6	78.2	564.8	643
HA92YK 140	27298	1118.5	26179.5		26179.5	29146	3944	2718	406	18842	3212	25178	6543.1	12298.9	625.3	11888.3	12513.6	79.7	545.6	625.3
HA92YK 141	27430	1110.3	26319.7		26319.7	28130	2750	1640	284	21706	1726	25356	2646.6	19059.4	1301.2	17925.1	19226.3	162.2	1139	1301.2
HA92YK 142	25902	1110.5	24791.5		24791.5	26056	2390	2492	444	17816	2882	23634	7616.2	10199.8	774	9766	10540	92.6	681.4	774
HA92YK 143.1	36782	1109.2	35672.8		35672.8	39140	4388	3790	696	25986	4248	34720	4293.6	21692.4	1458.4	20663.9	22122.3	183.5	1274.9	1458.4
HA92YK 143.2	26924	1125.4	25798.6		25798.6	27462	2330	2622	418	18908	3160	25108	3350.1	15557.9	1328.9	14559.2	15888.1	164.5	1164.4	1328.9
HA92YK 143.3	23994	1122.2	22871.8		22871.8	23102	1902	1092	388	18512	1166	21158	5769.7	12742.3	1432.3	11671.2	13103.5	183.6	1248.7	1432.3
HA92YK 143.4	14026	560.5	13465.5		13465.5	13270	1975	1232	214	8484	1316	11246	1054.8	7429.2	1265.3	6320.3	7585.6	159.3	1106	1265.3
HA92YK 144	25546	1123.8	24422.2		24422.2	24786	1544	1416	256	20046	1490	23208	11234.7	8811.3	426.7	8988.9	9415.6	54.5	372.2	426.7
HA92YK 145	14546	1104	13442		13442	14536	1552	786	138	11182	874	12980	1146	10036	610.9	9511.7	10122.6	75.8	535.1	610.9
HA92YK 146	21380	1118.9	20261.1		20261.1	21210	1554	1014	132	17222	1252	19620	14643.8	2578.2	376.4	2959.5	3335.9	48.3	328.1	376.4
HA92YK 147	19332	1119	18213		18213	19172	1602	1096	182	15138	1148	17564	3733.1	11404.9	408.2	12228.8	12637	51.4	356.8	408.2
CH92YK 148	29468	1126.8	28341.2	6023.4	22317.8	30596	3168	1764	332	23234	2058	27388	6023.4	17210.6	930.5	16702.2	17632.7	113.2	817.3	930.5
HA92YK 149	17382	1130.8	16251.2		16251.2	17286	1596	1770	266	11710	1924	15670	10310.9	1399.1	100.6	1960.1	2060.7	12.4	88.2	100.6
HA92YK 150	21426	1126.1	20299.9		20299.9	21140	1614	2158	328	14462	2368	19316	5834.6	8627.4	588.1	8681.5	9269.6	75.2	512.9	588.1
HA92YK 151	25906	1177.4	24728.6		24728.6	27034	3190	2606	398	18016	2782	23802	7520	10496	810.7	10225.6	11036.3	107.6	703.1	810.7
HA92YK 152	19946	1123	18823		18823	19680	1602	1896	266	13678	2226	18066	3419	10259	608.5	9791.9	10400.4	78.4	530.1	608.5
HA92YK 153	21776	1201.5	20574.5		20574.5	21380	1598	2076	324	14892	2472	19764	8906.8	5985.2	202.7	6794	6996.7	15.8	186.9	202.7
HA92YK154	16416	1078.7	15337.3		15337.3	16394	1570	886	134	12768	1008	14796	5240.5	7527.5	194.3	7567.4	7761.7	23.8	170.2	194
CH92YK 155	31614	1121.8	30492.2	7588.7	22903.5	31230	3142	1912	346	24786	2032	29076	7588.7	17197.3	1911.8	14639.1	16550.9	240.8	1671.2	1912
HA92YK 156	15102	557.8	14544.2		14544.2	15548	1668	1540	258	10380	1694	13872	7532.1	2847.9	491.7	2825.8	3317.5	63.4	428.3	491.7
HA92YK 157	27788	1107.2	26680.8		26680.8	28718	3090	2978	504	18966	3178	25626	6465.6	12500.4	795.4	12088	12883.4	99.3	695.9	795.2
HA92YK 158	14058	551	13507		13507	14040	1596	1454	278	9110	1594	12436	6005.1	3104.9	423.9	3053.8	3477.7	53.7	370.2	423.9
HA92YK 159	20344	1107.2	19236.8		19236.8	20170	1612	2260	382	13558	2348	18548	7120	6438	776.8	6478.6	7255.4	94.4	682.4	776.8
HA92YK 160	10572	543.1	10028.9		10028.9	9498	698	1040	210	6418	1130	8798	1823.4	4594.6	396.3	4308.3	4704.6	50.6	345.7	396.3
HA92YK 161	15612	555.9	15056.1	2378.3	12677.8	14532	1534	1594	286	9416	1700	12996	2378.3	7037.7	715.6	6427.5	7143.1	90	625.6	715.6
CH92YK 162	26710	1110.1	25599.9	2196	23403.9	27008	3186	2984	492	17340	2998	23814	2196	15144	1627.2	13639.8	15267	203.9	1422.7	1626.6
HA92YK 163	7358	554.1	6803.9	136.1	6667.8	6758	1308	690	122	3930	706	5448	136.1	3793.9	498.4	3304.2	3802.6	62.7	435.2	497.9
CH92YK 164	12374	553.1	11820.9	451.8	11369.1	12884	1824	1282	236	8100	1440	11058	451.8	7648.2	1020	6663	7683	125.1	894.6	1019.7
HA92YK 165	10130	558.1	9571.9		9571.9	10720	2392	836	116	6360	1008	8320	3208.6	3151.4	262.9	3020.2	3283.1	31.6	230.8	262.4
CH92YK 166	13214	560	12654	19.3	12634.7	14222	1976	1406	214	9104	1514	12238	19.3	9084.7	1457.9	7629.2	9087.1	181	1276.3	1457.3
HA92YK 167	7760	563.3	7196.7		7196.7	7536	1546	648	124	4486	734	5992	266.7	4219.3	495.6	3723.9	4219.5	60.4	435.2	495.6
CH92YK 168.1	12314	554.8	11759.2	38.5	11720.7	13020	1902	1222	196	8346	1338	11102	38.5	8307.5	1188.5	7109.2	8297.7	148.8	1039.5	1188.3
CH92YK 168.2	13150	553.6	12596.4	8.6	12587.8	13458	1554	1200	216	8914	1584	11914	8.6	8905.4	912.7	7979.8	8892.5	111.3	801	912.3

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	**Gross**	**Tare**	**Net**	**+10 Mesh**	**-10 Mesh**	**Gross**	**Tare**	**Archive**	**Head**	**Spiral**	**Flotation**	**Total**	**+10 Mesh**	**-10 Mesh**	**Conc.**	**Reject**	**Total**	**Assay**	**ALRC**	**Total**
CH92YK 168.3	13274	552.7	12721.3	227.5	12493.8	13398	1530	1344	232	8802	1460	11838	227.5	8574.5	1145.8	7441	8586.8	141.9	1003	1144.9
HA92YK 169	5699.5	43.7	5655.8		5655.8	13645	3340	1095	210	7770	1235	10310	49	7721	244.3	3233.6	3477.9	19.8	224.5	244.3
CH92YK 170.1	11582	554	11028	45	10983	11754	1606	1130	186	7640	1190	10146	45	7595	1417.7	6196.3	7614	176.7	1240.6	1417.3
CH92YK 170.2	11624	557.8	11066.2	6.1	11060.1	11930	1568	1152	170	7788	1252	10362	6.1	7781.9	1188.1	6572.2	7760.3	145.5	1041.6	1187.1
CH92YK 170.3	11922	553.6	11368.4	104.3	11264.1	12190	1606	1188	186	7888	1324	10586	104.3	7783.7	975.9	6808.5	7784.4	125.7	849.6	975.3
HA92YK 171	7344	557.2	6786.8		6786.8	7358	1554	670	114	4260	760	5804	1884.4	2375.6	211.1	2243.7	2454.8	27	184.1	211.1
CH92YK 172	11428	559.5	10868.5	151.8	10716.7	11816	1588	1130	186	7684	1228	10228	151.8	7532.2	721.8	6816	7537.8	89	632.3	721.3
HA92YK 173	12628	555.6	12072.4		12072.4	12420	1606	1142	190	8142	1338	10812	2097.3	6044.7	212.5	5955.9	6168.4	26.9	185.6	212.5
CH92YK 174	12340	558.4	11781.6	86.6	11695	12328	1618	1212	208	8016	1270	10706	86.6	7929.4	945.9	7013.3	7959.2	118.6	825.6	944.2
HA92YK 175	10408	550.1	9857.9		9857.9	11068	1574	990	164	7120	1230	9504	3824.8	3295.2	212.5	3174.9	3387.4	26.3	186.2	212.5
HA92YK 176	9436	552.9	8883.1		8883.1	8644	1606	874	110	5120	928	7032	52.9	5067.1	386.9	4642	5028.9	48.1	338.8	386.9
HA92YK 177	22038	1105.4	20932.6		20932.6	22582	3176	1954	308	14600	2520	19382	6206.6	8393.4	888.5	7833.9	8722.4	110.3	778.2	888.5
HA92YK 178.1	22810	1103.6	21706.4	90.9	21615.5	23862	3168	2310	364	15412	2598	20684	90.9	15321.1	2262.8	13048.1	15310.9	274.3	1988.1	2262.4
HA92YK 178.2	10172	551	9621		9621	8918	NONE	1064	230	6542	1082	8918	431.3	6110.7	396	5733.5	6129.5	48.8	347.2	396
HA92YK 179	7406	553.5	6852.5		6852.5	7274	1670	628	128	4212	634	5602	12.6	4199.4	530.9	3664.2	4195.1	67.9	463	530.9
HA92YK 180	8280	551.3	7728.7		7728.7	7929	1636	684	142	4686	778	6290	0	4686	589.5	4099.1	4688.6	74.7	514.8	589.5
HA92YK 181	19360	1109.9	18250.1		18250.1	17440	1556	1704	298	11898	1974	15874	36.1	11861.9	2042.6	9798.4	11841	254.5	1788.1	2042.6
HA92YK 182	5138	556.4	4581.6		4581.6	4454	702	420	110	2780	446	3756	0	2780	149.1	2608.2	2757.3	18.7	130.4	149.1
HA92YK 183	13084	556	12528		12528	12026	1600	1096	206	7874	1236	10412	0	7874	1207.6	6625.8	7833.4	147.8	1059.8	1207.6
HA92YK 184	14356	551.7	13804.3		13804.3	13494	1612	1280	238	8930	1434	11882	0	8930	532.9	8392.6	8925.5	68.9	464	532.9
HA92YK 185	13384	1119.2	12264.8		12264.8	13354	1560	1302	254	8808	1414	11778	5033.7	3774.3	263.8	3794.9	4058.7	34	229.8	263.8
HA92YK 186	27440	1120.6	26319.4		26319.4	27616	3066	2638	466	18440	2958	24502	3452.4	14987.6	558.6	14925.2	15483.8	70.7	487.9	558.6
CH92YK 187	37868	1130.8	36737.2	20500	16237.2	39316	3410	3940	610	26676	4612	35838	20500	6176	415.3	6175.5	6590.8	51.7	362.9	414.6
RS92YK 188	16342	554.8	15787.2		15787.2	14732	1570	1488	242	9884	1540	13154	1618.7	8265.3	590.5	7739.3	8329.8	73.3	517.2	590.5
RS92YK 189	14738	557.8	14180.2		14180.2	13324	1554	1450	250	8564	1500	11764	1791.9	6772.1	460.2	6454.6	6914.8	57.8	402.4	460.2
RS92YK 190	17220	558.6	16661.4		16661.4	15452	1608	1408	260	10492	1670	13830	4059	6433	490.8	6354.9	6845.7	60.7	430.1	490.8
RS92YK 191	15164	560.5	14603.5		14603.5	13314	1554	1280	286	8786	1408	11760	2585.9	6200.1	435.8	5956.7	6392.5	53.6	382.2	435.8
RS92YK 192	14422	560.8	13861.2	1314	12547.2	12446	1618	1358	248	7814	1396	10816	1314	6500	462.5	6338.3	6800.8	57.8	404.7	462.5
RS92YK 193	15780	561.2	15218.8		15218.8	13852	1576	1506	266	8926	1568	12266	4881	4045	172.1	4956.9	5129	21.3	150.8	172.1
RS92YK 194	15612	553.9	15058.1		15058.1	14286	1546	1512	280	9256	1676	12724	3447	5809	417	5562	5979	53.2	363.8	417
RS92YK 195	17960	559	17401		17401	16808	1610	1908	326	10958	1990	15182	3933.1	7024.9	473.2	7421.8	7895	58.3	414.9	473.2
HA92YK 196	7036	555	6481		6481	7426	2394	614	100	3670	648	5032	128.8	3541.2	240.1	3294.2	3534.3	30.5	209.6	240.1
HA92YK 197	9760	552.2	9207.8		9207.8	10804	1904	938	170	6614	1168	8890	5562.5	1051.5	79	1283.6	1362.6	9.8	69.2	79
HA92YK 198	13014	551	12463		12463	13996	1978	1414	224	8838	1528	12004	5454.3	3383.7	265.7	3270.9	3536.6	31.9	233.8	265.7

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	Gross	Tare	Net	+10 Mesh	-10 Mesh	Gross	Tare	Archive	Head	Spiral	Flotation	Total	+10 Mesh	-10 Mesh	Conc.	Reject	Total	Assay	ALRC	Total
HA92YK 199	12094	552	11542	3472.5	8069.5	12796	1602	1194	236	8186	1550	11166	3472.5	4713.5	472.9	4309.4	4782.3	58.2	414.7	472.9
HA92YK 200	12412	555.3	11856.7		11856.7	12852	1532	1052	262	8544	1450	11308	2533.4	6010.6	386.4	5745.7	6132.1	47	339.4	386.4
HA92YK 301	15282	555	14727		14727	13948	1574	1248	260	9432	1238	12178	56.3	9375.7	717.3	8684.1	9401.4	86.7	630.6	717.3
HA92YK 302	22822	1103.3	21718.7		21718.7	23876	3202	2508	426	15064	2666	20664	1176.1	13887.9	942.5	12999.8	13942.3	118.5	824	942.5
HA92YK 303	13176	550.2	12625.8		12625.8	12564	1572	1380	220	7966	1426	10992	1965.1	6000.9	307.1	5781.5	6088.6	38.9	268.2	307.1
HA92YK 304	20316	1105.3	19210.7		19210.7	21522	3174	2280	370	13346	2350	18346	154.2	13191.8	1334.2	11858.6	13192.8	173.7	1160.5	1334.2
HA92YK 305	13432	550.8	12881.2		12881.2	13964	1614	1556	218	8994	1584	12352	303.1	8690.9	670.7	8035	8705.7	85.3	585	670.3
HA92YK 306	13390	552.2	12837.8		12837.8	12452	1600	1086	204	8256	1304	10850	869.6	7386.4	549.3	6850.3	7399.6	67	482.3	549.3
HA92YK 307	23132	1106.5	22025.5	43.9	21981.6	22612	3238	2044	288	14656	2382	19370	43.9	14612.1	2051.3	12551.7	14603	261.2	1789.4	2050.6
HA92YK 308	13522	553.9	12968.1		12968.1	13360	1556	1166	246	8948	1446	11806	33.9	8914.1	785	8131.5	8916.5	97.2	687.8	785
HA92YK 309	5912	553.3	5358.7		5358.7	6316	1672	502	130	3418	596	4646	465	2953	81.8	2886.4	2968.2	10.4	71.4	81.8
HA92YK 310	4486	45.5	4440.5		4440.5	10075	1935	935	235	6050	920	8140	30.4	6019.6	187.9	2516.9	2704.8	23.7	164.2	187.9
HA92YK 311	10552	553.3	9998.7		9998.7	8896	700	872	194	6104	1028	8198	0	6104	530.9	5555.3	6086.2	66.3	464.6	530.9
HA92YK 312	16812	554.2	16257.8		16257.8	15152	1556	1400	248	10246	1700	13594	8.4	10237.6	1399.6	8808.4	10208	176.9	1222.8	1399.7
HA92YK 313	6068.5	45.7	6022.8		6022.8	14635	3670	1105	325	8295	1245	10970	0	8295	357.7	3398.2	3755.9	44.7	313	357.7
HA92YK 314	14666	558.4	14107.6		14107.6	13360	1538	1524	238	8528	1526	11816	10.6	8517.4	1475	7028.2	8503.2	180	1295	1475
HA92YK 315	14766	553.1	14212.9		14212.9	14044	1902	1286	240	9146	1468	12140	0	9146	627.5	8510.5	9138	78.2	551.3	629.5
HA92YK 316	5429.3	45.9	5383.4		5383.4	11800	2016	1025	265	7365	1130	9785	9.8	7355.2	308.9	3017.4	3326.3	39.2	269.7	308.9
HA92YK 317	8550	552.8	7997.2		7997.2	7600	1300	702	192	4660	768	6322	21.2	4638.8	480	4140.9	4620.9	59.3	420.7	480
HA92YK 318	14072	552.9	13519.1		13519.1	12746	1528	1414	234	8136	1436	11220	0	8136	811.7	7317.3	8129	101.7	710	811.7
PA92YA 701.1	7012	515	6497			8614	1592	676	98	5390	840	7004	18.8	5371.2	958.4	4399.1	5357.5	117.3	841.1	958.4
PA92YA 701.2	4904	515	4389			6438	1526	550	78	3686	582	4896	91.6	3594.4	293.3	3302.7	3596	36.2	257.1	293.3
PA92YA 701.3	7164	515	6649			8786	1610	792	98	5450	820	7160	210.9	5239.1	382	4865.8	5247.8	48.5	333.5	382
PA92YA 701.4	7582	515	7067			9198	1602	780	104	5702	994	7580	109.5	5592.5	307.4	5285.6	5593	39.3	268.1	307.4
PA92YA 701.5	9582	515	9067			11152	1554	988	124	7278	1174	9564	63	7215	407.7	6788.6	7196.3	52	355.7	407.7
PA92YA 701.6	5288	515	4773			6930	1630	568	76	4018	624	5286	47.1	3970.9	241.9	3718.8	3960.7	29.9	212	241.9
PA92YA 702.1	6305.7	515	5790.7			6328	1820	464	48	3468	510	4490	0	3468	162.3	3287	3449.3	20	142.3	162.3
PA92YA 702.2	10745.1	515	10230.1			9674	1566	816	130	6186	944	8076	9.6	6176.4	317.5	5817.2	6134.7	40.7	276.8	317.5
PA92YA 702.3	13508.4	515	12993.4			12120	1532	1046	222	8120	1168	10556	165.3	7954.7	421.3	7499.2	7920.5	52.1	369.2	421.3
PA92YA 702.4	14160	515	13645			13306	1976	1246	344	8276	1430	11296	114.1	8161.9	393.8	7729.4	8123.2	50.2	343.6	393.8
PA92YA 703.1	9406.4	515	8891.4			8618	1614	792	252	5142	878	7064	0	5142	678.3	4441.8	5120.1	85.1	593.2	678.3
PA92YA 703.2	17500	515	16985			15774	1528	1414	202	10870	1744	14230	159.1	10710.9	567.8	10096.7	10664.5	71.8	496	567.8
PA92YA 703.3	11620.3	515	11105.3			10536	1596	962	136	6782	1036	8916	327.7	6454.3	400.6	6067.2	6467.8	50.2	350.4	400.6
PA92YA 703.4	10860.2	515	10345.2			10008	1604	922	124	6340	1018	8404	440.3	5899.7	213.1	5695.2	5908.3	27	186.1	213.1

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	**Gross**	**Tare**	**Net**	**+10 Mesh**	**-10 Mesh**	**Gross**	**Tare**	**Archive**	**Head**	**Spiral**	**Flotation**	**Total**	**+10 Mesh**	**-10 Mesh**	**Conc.**	**Reject**	**Total**	**Assay**	**ALRC**	**Total**
PA92YA 704.1	8693.4	515	8178.4			8446	1532	698	96	5022	780	6596	23.8	4998.2	756.4	4220.5	4976.9	95.4	661	756.4
PA92YA 704.2	9034.2	515	8519.2			8448	1528	706	82	5302	820	6910	320.7	4981.3	428.9	4565.2	4994.1	52.4	376.5	428.9
PA92YA 704.3	9246.4	515	8731.4			8626	1566	718	140	5354	836	7048	208.1	5145.9	452.8	4696	5148.8	56.9	395.9	452.8
PA92YA 704.4	9968.8	515	9453.8			9316	1526	852	118	5878	928	7776	1287.2	4590.8	429.6	4212	4641.6	54.6	375	429.6
PA92YA 704.5	10158.5	515	9643.5			9576	1602	864	132	5920	1048	7964	1196.3	4723.7	463.1	4265.6	4728.7	56.9	406.2	463.1
PA92YA 705.1	9602.7	515	9087.7			9330	1630	852	120	5630	1150	7752	54.2	5575.8	1640.2	3909.1	5549.3	209.6	1430.6	1640.2
PA92YA 705.2	8295.1	515	7780.1			8030	1592	664	132	4882	736	6414	193.7	4688.3	472.3	4196.3	4668.6	59.2	413.1	472.3
PA92YA 705.3	6344	515	5829			6458	1604	512	66	3624	634	4836	239	3385	432.1	2914.4	3346.5	53.7	378.4	432.1
PA92YA705.4	11001.1	515	10486.1			10521	1554	964	112	6850	990	8916	356.7	6493.3	750.5	5696.5	6447	93.8	656.7	750.5
PA92YA 705.5	11955.8	515	11440.8			11552	1610	1122	278	7346	1150	9896	1498.2	5847.8	776.2	5116.6	5892.8	99.3	676.9	776.2
PA92YA 706	10481.7	515	9966.7			9840	1596	792	360	6088	990	8230	0	6088	800.3	5257.3	6057.6	101.1	699.2	800.3
PA92YA 707.1	6756.2	515	6241.2			6680	1582	510	118	3904	570	5102	0	3904	717.2	3149.3	3866.5	89.5	627.7	717.2
PA92YA 707.2	7734.5	515	7219.5			7220	1558	628	138	4276	612	5654	0	4276	364.3	3887.2	4251.5	46.2	318.1	364.3
PA92YA 707.3	16600	515	16085			14922	1554	1480	340	9946	1660	13426	55.8	9890.2	480.3	9372.9	9853.2	61.7	418.6	480.3
PA92YA 707.4	15364	515	14849			13742	1592	1280	334	9164	1372	12150	35	9129	524.5	8574.5	9099	66.6	457.9	524.5
PA92YA 708.1	9258.1	515	8743.1			8768	1620	816	208	5344	780	7148	0	5344	968.8	4347.8	5316.6	122.8	846	968.8
PA92YA 708.2	10333.8	515	9818.8			9494	1560	882	214	5982	852	7930	32.7	5949.3	492.3	5435.1	5927.4	63.3	429	492.3
PA92YA 708.3	17500	515	16985			15720	1604	1264	352	10966	1530	14112	67.5	10898.5	662.9	10207.5	10870.4	83.9	579	662.9
PA92YA 708.4	12510.1	515	11995.1			11228	1576	908	222	7520	990	9640	66.4	7453.6	487.8	6953.9	7441.7	62.6	425.2	487.8
PA92YA 709.1	9145.3	515	8630.3			8526	1574	712	142	5276	814	6944	0	5276	1026.6	4200.2	5226.8	130.6	896	1026.6
PA92YA 709.2	17900	515	17385			16150	1616	1428	318	11196	1566	14508	108.8	11087.2	874.8	10172.6	11047.4	108	766.8	874.8
PA92YA 709.3	12046.7	515	11531.7			10726	1558	906	238	7076	934	9154	74.2	7001.8	461.3	6517	6978.3	58.8	402.5	461.3
PA92YA 709.4	12288.6	515	11773.6			11244	1608	1134	184	7114	1196	9628	87.7	7026.3	546	6472.3	7018.3	67.7	478.3	546
PA92YA 710.1	9277.6	515	8762.6			8794	1612	712	314	5282	868	7176	0	5282	742.9	4475.9	5218.8	91.2	651.7	742.9
PA92YA 710.2	17200	515	16685			15258	1542	1304	326	10618	1450	13698	38.8	10579.2	824.8	9713.1	10537.9	100.6	724.2	824.8
PA92YA 710.3	17200	515	16685			15172	1540	1256	278	10788	1300	13622	52.5	10735.5	743.6	9941.4	10685	92	651.6	743.6
PA92YA 711.1	7982.5	515	7467.5			7604	1538	662	206	4526	668	6062	0	4526	617	3890.1	4507.1	78	539	617
PA92YA 711.2	6595.2	515	6080.2			6570	1604	604	182	3656	520	4962	0	3656	464.5	3160.8	3625.3	57.1	407.4	464.5
PA92YA 711.3	9759.4	515	9244.4			9046	1634	832	238	5492	828	7390	0	5492	460.8	5014	5474.8	58.5	402.3	460.8
PA92YA 711.4	10250	515	9735			9538	1602	686	350	6074	826	7936	12.8	6061.2	602.5	5449.5	6052	74.1	528.4	602.5
PA92YA 711.5	9335	515	8820			8654	1596	704	260	5380	704	7048	14.2	5365.8	553.5	4806.4	5359.9	68	485.5	553.5
PA92YA 712.1	7145.2	515	6630.2			7048	1590	704	120	3936	690	5450	290.4	3645.6	365.1	3286.6	3651.7	48.6	316.5	365.1
PA92YA 712.2	7139.5	515	6624.5			7016	1608	686	102	3902	710	5400	198	3704	324.5	3322.1	3646.6	39.3	285.2	324.5
PA92YA 712.3	9405.4	515	8890.4			8888	1574	876	162	5314	952	7304	373	4941	352.7	4611.3	4964	44.8	307.9	352.7

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	**Gross**	**Tare**	**Net**	**+10 Mesh**	**-10 Mesh**	**Gross**	**Tare**	**Archive**	**Head**	**Spiral**	**Flotation**	**Total**	**+10 Mesh**	**-10 Mesh**	**Conc.**	**Reject**	**Total**	**Assay**	**ALRC**	**Total**
PA92YA 712.4	10835.9	515	10320.9			10386	1604	1076	172	6382	1146	8776	1301.5	5080.5	375.9	4779.5	5155.4	46	329.9	375.9
PA92YA 712.5	7581.7	515	7066.7			7386	1556	730	116	4194	782	5822	759.7	3434.3	270	3189.1	3459.1	33.5	236.5	270
PA92YA 713.1	8366.9	515	7851.9			7910	1554	798	134	4638	794	6364	0	4638	454.1	4158.5	4612.6	56.2	397.9	454.1
PA92YA 713.2	12537.2	515	12022.2			11732	1546	1736	456	5460	2520	10172	1186.7	4273.3	317.4	4024.1	4341.5	40.7	276.7	317.4
PA92YA 713.3	16600	515	16085			15408	1576	2470	528	7590	3234	13822	1745.3	5844.7	422.7	5554.5	5977.2	52.1	370.6	422.7
PA92YA714.1	7125.8	515	6610.8			7086	1610	1084	304	2916	1164	5468	8.3	2907.7	248.9	2655.1	2904	31.7	217.2	248.9
PA92YA 714.2	13695.1	515	13180.1			12548	1614	2310	474	5634	2506	10924	17.1	5616.9	461.3	5146.5	5607.8	57.9	403.4	461.3
PA92YA 714.3	16300	515	15785			14742	1608	1080	268	10478	1298	13124	148.1	10329.9	622.4	9686.4	10308.8	78.9	543.5	622.4
PA92YA 715.1	7180.3	515	6665.3			7176	1604	538	168	4288	580	5574	0	4288	351	3914	4265	42.1	308.9	351
PA92YA 715.2	16500	515	15985			14522	1558	1138	316	10168	1328	12950	0	10168	878.1	9248.7	10126.8	110.8	767.3	878.1
PA92YA 715.3	17900	515	17385			16326	1532	1334	338	11714	1400	14786	328.7	11385.3	771.4	10600.7	11372.1	95.9	675.5	771.4
PA92YA 716.1	8207.3	515	7692.3			7692	1572	690	106	4578	732	6106	0	4578	295.8	4245.8	4541.6	36.8	259	295.8
PA92YA 716.2	9242.6	515	8727.6			8668	1602	770	118	5382	790	7060	57.4	5324.6	444.4	4848.8	5293.2	55.7	388.7	444.4
PA92YA 716.3	9007.6	515	8492.6			8374	1538	688	110	5270	758	6826	64.3	5205.7	407.7	4780.2	5187.9	52.2	355.5	407.7
PA92YA 716.4	11157.2	515	10642.2			10084	1548	836	128	6652	900	8516	72.2	6579.8	513.3	6029.4	6542.7	66.7	446.6	513.3
PA92YA 716.5	12278.5	515	11763.5			11106	1642	1004	176	7236	1036	9452	201.2	7034.8	522.6	6495.2	7017.8	66.4	456.2	522.6
PA92YA 717.1	6147.1	515	5632.1			6104	1556	516	138	3374	522	4550	0	3374	499.8	2843.1	3342.9	63.2	436.6	499.8
PA92YA 717.2	5589.9	515	5074.9			5450	1576	462	122	2834	452	3870	2.8	2831.2	415.5	2405.8	2821.3	52.5	363	415.5
PA92YA 717.3	9226.2	515	8711.2			8532	1560	732	208	5254	778	6972	350.1	4903.9	589.2	4322.1	4911.3	78	511.2	589.2
PA92YA717.4	7251.8	515	6736.8			7356	1612	626	164	4286	660	5736	1171.1	3114.9	382.6	2786.4	3169	49.2	333.4	382.6
PA92YA 717.5	8668	515	8153			8216	1606	742	180	4902	780	6604	1299.6	3602.4	250.7	3316.4	3567.1	44.1	206.6	250.7
HA92YA 801.1	27942	1030	26912			28482	3192	2576	450	19218	3038	25282	0	19218	4009.2	15185.8	19195	514	3495.2	4009.2
HA92YA801.2	15000	1030	13970			14884	1606	1356	342	9924	1648	13270	0	9924	1696	8231	9927	215	1481	1696
HA92YA 802	34400	1030	33370			34368	3126	3478	716	22984	4036	31214	0	22984	4225.3	18693.3	22918.6	526.8	3698.5	4225.3
HA92YA 803.1	24700	1030	23670			25190	3130	2316	486	16838	2406	22046	0	16838	2538.5	14290.5	16829	318.1	2220.4	2538.5
HA92YA 803.2	30000	1030	28970			30018	3242	2888	594	19802	3470	26754	0	19802	3023.6	16742.5	19766.1	379.1	2644.5	3023.6
HA92YA 804	6965.4	515	6450.4			6748	1574	572	130	3834	636	5172	0	3834	372.5	3426.6	3799.1	47	325.5	372.5
HA92YA 805	9373.8	1030	8343.8			8394	1538	690	134	5156	876	6856	0	5156	360.4	4763.8	5124.2	45.6	314.8	360.4
HA92YA 806.1	24905.6	1030	23875.6			25496	3168	2394	492	16680	2750	22316	0	16680	3658.3	13007.6	16665.9	452.6	3205.7	3658.3
HA92YA 806.2	29300	1030	28270			28710	3170	2700	622	18954	3058	25334	0	18954	4537.2	14384.4	18921.6	572.1	3965.1	4537.2
HA92YA 807	21800	1030	20770			21688	3172	2082	402	13788	2214	18486	0	13788	1858.7	11896.1	13754.8	236.7	1622	1858.7
HA92YA 808	5685.9	515	5170.9			5702	1540	426	126	3132	480	4164	0	3132	311.3	2802.4	3113.7	39.7	271.6	311.3
HA92YA 809.1	24400	1030	23370			25110	3176	2348	518	16294	2764	21924	0	16294	2759.9	13517.9	16277.8	355.3	2404.6	2759.9
HA92YA 809.2	30100	1030	29070			28746	3168	2718	482	19078	3300	25578	0	19078	3531.5	15484.4	19015.9	428.9	3102.6	3531.5

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	Gross	Tare	Net	+10 Mesh	-10 Mesh	Gross	Tare	Archive	Head	Spiral	Flotation	Total	+10 Mesh	-10 Mesh	Conc.	Reject	Total	Assay	ALRC	Total
HA92YA 810	8315.3	515	7800.3			7760	1574	610	194	4734	650	6188	0	4734	388.3	4315.5	4703.8	49.3	339	388.3
HA92YA 811	6888.5	515	6373.5			6766		552	168	3932	532	5184	0	3932	282.4	3628.6	3911	35.4	247	282.4
HA92YA 812.1	23693.2	1030	22663.2			24566	3366	2392	474	15660	2662	21188	0	15660	2212	13429.3	15641.3	276.2	1935.8	2212
HA92YA 812.2	30700	1030	29670			29334	3170	2626	626	19546	3304	26102	0	19546	2700.1	16834.4	19534.5	336.3	2363.8	2700.1
HA92YA 813	8902.8	515	8387.8			8300	1582	728	172	4996	792	6688	0	4996	456.3	4505.1	4961.4	56.6	399.7	456.3
HA92YA 814	11243.2	515	10728.2			9974	1542	912	178	6292	1032	8414	0	6292	499.2	5747.6	6246.8	63	436.2	499.2
HA92YA 815.1	26169.4	1030	25139.4			26780	3198	2780	574	17308	2910	23572	0	17308	3551.7	13728.8	17280.5	452	3099.7	3551.7
HA92YA 815.2	29137.8	1030	28107.8			28128	3160	2718	450	18336	3428	24932	109.9	18226.1	2133.3	16003.8	18137.1	258.9	1874.4	2133.3
HA92YA 816	13464	1030	12434			16382	1634	1788	280	10686	1986	14740	0	10686	984.8	9678.6	10663.4	124	860.8	984.8
HA92YA 817.1	28967.4	1030	27937.4			29472	3202	3126	476	18990	3654	26246	0	18990	4416.2	14561.2	18977.4	566.3	3849.9	4416.2
HA92YA 817.2	15436.1	515	14921.1			15670	1570	1728	284	10204	1874	14090	423.3	9780.7	2046.6	7715.8	9762.4	262.6	1784	2046.6
HA92YA 818.1	22174.3	1030	21144.3			23202	3144	2202	418	14882	2538	20040	10.1	14871.9	1640.1	13214.7	14854.8	203.2	1436.9	1640.1
HA92YA 818.2	23818.2	1030	22788.2			23356	3184	2090	542	15256	2270	20158	0	15256	2578.8	12638.3	15217.1	318.4	2260.4	2578.8
HA92YA 819	13937.7	515	13422.7			12788	1556	1404	272	8194	1356	11226	3.6	8190.4	1470	6715.1	8185.1	182.5	1287.5	1470
HA92YA 820	18400	515	17885			18756	1608	2028	392	12494	2224	17138	0	12494	5474.2	7011.8	12486	704	4770.2	5474.2
HA92YA 821	12521.3	515	12006.3			11082	1630	1216	186	6822	1210	9434	0	6822	797.7	5997.6	6795.3	99.8	697.9	797.7
HA92YA 822	14398.4	515	13883.4			13044	1564	1104	208	8878	1282	11472	0	8878	784.5	8041	8825.5	100.8	683.7	784.5
HA92YA 823	14435.7	515	13920.7			14228	1530	1390	304	9436	1562	12692	3.3	9432.7	1141.6	8250.1	9391.7	139.5	1002.1	1141.6
HA92YA 824	22500	1030	21470			23592	3368	2202	504	15144	2368	20218	99.2	15044.8	1688.8	13256.6	14945.4	212.1	1476.7	1688.8
HA92YA 825	10630.6	515	10115.6			11258	1590	1134	230	7076	1200	9640	2593.7	4482.3	319.9	4456.4	4776.3	41	278.9	319.9
HA92YA 826	15264.1	515	14749.1			15454	1576	1462	312	10406	1674	13854	6293.4	4112.6	319.7	4051.8	4371.5	41	278.7	319.7
HA92YA 827.1	27500	1030	26470			28474	3138	2922	568	18566	3260	25316	0	18566	5134.4	13427.6	18562	653.2	4481.2	5134.4
HA92YA 827.2	29900	1030	28870			29586	3151	3042	570	19586	3214	26412	7.7	19578.3	3562.2	15948.4	19510.6	447.9	3114.3	3562.2
HA92YA 828.1	23800	1030	22770			24854	3238	2374	536	15970	2722	21602	0	15970	1857.5	14100.4	15957.9	221.9	1635.6	1857.5
HA92YA 828.2	26900	1030	25870			26372	3235	4542	540	12132	6020	23234	6.8	12125.2	1451.8	10650.5	12102.3	177.8	1274	1451.8
HA92YA 829.1	24700	1030	23670			25520	3138	2140	256	17366	2590	22352	0	17366	3737.6	13594.8	17332.4	474.6	3263	3737.6
HA92YA 829.2	31100	1030	30070			29614	3108	2548	314	20592	3036	26490	0	20592	4344.2	16212.2	20556.4	544.7	3799.5	4344.2
HA92YA 830.1	22400	1030	21370			23044	3140	1814	200	15608	2270	19892	0	15608	1169.1	14369.1	15538.2	161.3	1007.8	1169.1
HA92YA 830.2	9700	515	9185			9000	1564	732	184	5758	862	7536	0	5758	586.2	5100.7	5686.9	71.3	514.9	586.2
HA92YA 831	21600	1030	20570			21464	3432	1750	208	13966	2092	18016	0	13966	774.9	13112.8	13887.7	96	678.9	774.9
HA92YA 832.1	24500	1030	23470			25344	3196	1906	266	17468	2494	22134	0	17468	4025.6	13404.4	17430	510.5	3515.1	4025.6
HA92YA 832.2	31100	1030	30070			30038	3252	2170	254	21466	2876	26766	0	21466	4079.5	17366.4	21445.9	522.5	3557	4079.5
HA92YA 833	16800	1030	15770			15616	1980	1216	102	10768	1528	13614	0	10768	1292.8	9425.4	10718.2	162.7	1130.1	1292.8
HA92YA 834.1	24400	1030	23370			25416	3208	2104	270	17110	2706	22190	0	17110	3380.3	13715.2	17095.5	413.9	2966.4	3380.3

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	Gross	Tare	Net	+10 Mesh	-10 Mesh	Gross	Tare	Archive	Head	Spiral	Flotation	Total	+10 Mesh	-10 Mesh	Conc.	Reject	Total	Assay	ALRC	Total
HA92YA 834.2	15700	515	15185			14570	1558	1184	154	10198	1474	13010	0	10198	2798.6	7359.5	10158.1	335.2	2463.4	2798.6
HA92YA 835	12600	515	12085			12322	1614	1002	154	8268	1280	10704	0	8268	1001.8	7232.7	8234.5	125.4	876.4	1001.8
HA92YA 836	11300	515	10785			10256	1576	810	116	6782	966	8674	0	6782	616.5	6124.8	6741.3	74.6	541.9	616.5
HA92YA 837.1	26700	1030	25670			27412	3176	2368	286	18604	2960	24218	0	18604	3741	14828.6	18569.6	464.4	3276.6	3741
HA92YA 837.2	17700	515	17185			16014	1532	1232	146	11456	1642	14476	0	11456	1987.2	9451.9	11439.1	247.5	1739.7	1987.2
HA92YA 838.1	22573.3	1030	21543.3			23100	3128	1932	416	15172	2448	19968	0	15172	1494.7	13628.3	15123	190.7	1304	1494.7
HA92YA 838.2	14727.6	515	14212.6			13360	1560	1264	312	8724	1480	11780	0	8724	684	7993.5	8677.5	93.8	590.2	684
HA92YA 839	12124.8	515	11609.8			11442	1984	1012	206	6924	1294	9436	0	6924	654.1	6237.2	6891.3	90	564.1	654.1
HA92YA 840.1	25059.5	1030	24029.5			25698	3160	2370	486	17062	2556	22474	0	17062	4152.8	12880.9	17033.7	514.6	3638.2	4152.8
HA92YA 840.2	16100	515	15585			14708	1602	1458	318	9640	1664	13080	0	9640	1981.8	7639.3	9621.1	241.1	1740.7	1981.8
HA92YA 841.1	20206.8	1030	19176.8			20915	3162	1986	386	13374	1982	17728	3.2	13370.8	1161.7	12169	13330.7	145.7	1016	1161.7
HA92YA 841.2	10141.6	515	9626.6			9362	1618	840	260	5774	852	7726	3.4	5770.6	297.1	5447.7	5744.8	36	261.1	297.1
HA92YA 842.1	25200	1030	24170			25922	3172	2634	500	16758	2820	22712	0	16758	2299.8	14442.4	16742.2	296.7	2003.1	2299.8
HA92YA 842.2	14537.9	515	14022.9			13660	1610	1428	302	8822	1482	12034	0	8822	1234.4	7584.4	8818.8	163.4	1071	1234.4
HA92YA 843.1	20700	1030	19670			21730	3090	2106	442	13884	2188	18620	0	13884	1062.9	12797.1	13860	142.1	920.8	1062.9
HA92YA 843.2	25500	1030	24470			25615	3394	2528	482	16348	2818	22176	0	16348	1379.3	14930.4	16309.7	183.5	1195.8	1379.3
HA92YA 844	10125.5	515	9610.5			10120	1554	946	188	6276	1152	8562	18.9	6257.1	232.6	5938.8	6171.4	31.2	201.4	232.6
HA92YA 845.1	27600	1030	26570			28450	3234	2808	616	18528	3250	25202	0	18528	2991	15499.5	18490.5	379.2	2611.8	2991
HA92YA 845.2	28900	1030	27870			27222	3216	2452	490	18144	2896	23982	0	18144	1797.5	16330	18127.5	223.6	1573.9	1797.5
HA92YA 846.1	22400	1030	21370			23472	3124	2178	468	15342	2344	20332	0	15342	944.4	14367.6	15312	123.8	820.6	944.4
HA92YA 846.2	23400	1030	22370			23902	3378	2094	454	15434	2514	20496	20.5	15413.5	269.9	14628.2	14898.1	81.4	188.5	269.9
CH92YA 847.1	11195.7	515	10680.7			11792	1600	1112	274	7578	1242	10206	0	7578	944.2	6605.9	7550.1	128	816.2	944.2
CH92YA 847.2	12270.8	515	11755.8			12656	1530	1124	294	8480	1216	11114	0	8480	1259.4	7214.7	8474.1	156.2	1103.2	1259.4
CH92YA 847.3	12000	515	11485			12348	1536	1036	276	8340	1104	10756	0	8340	1198.1	7123.8	8321.9	159.4	1038.7	1198.1
CH92YA 847.4	11100	515	10585			11560	1556	1106	270	7582	1192	10150	0	7582	664.1	6912.4	7576.5	93.3	570.8	664.1
HA92YA 848.1	25300	1030	24270			26516	3580	2370	584	16962	2998	22914	0	16962	2234.9	14716	16950.9	280.3	1954.6	2234.9
HA92YA 848.2	24600	1030	23570			23396	3222	2354	508	14740	2560	20162	0	14740	1426.7	13292.4	14719.1	180.5	1246.2	1426.7
HA92YA 849	15800	515	15285			15700	1568	1552	402	10288	1882	14124	0	10288	4750.9	5537.8	10288.7	521.3	4229.6	4750.9
CH92YA 850.1	10100	515	9585			10890	1824	838	100	7088	1034	9060	0	7088	256	6827.5	7083.5	30.4	225.6	256
CH92YA 850.2	11900	515	11385			12570	1978	1038	138	8202	1208	10586	0	8202	1125.4	7072.7	8198.1	139.7	985.7	1125.4
CH92YA 850.3	13800	515	13285			14226	1612	1308	178	9560	1560	12606	12.1	9547.9	2187.3	7359.4	9546.7	278.1	1909.2	2187.3
CH92YA 850.4	13800	515	13285			13838	1602	1252	184	9344	1448	12228	0	9344	1989.2	7338.3	9327.5	244.7	1744.5	1989.2
HA92YA 851	13100	515	12585			13574	1618	1164	164	9180	1434	11942	16.3	9163.7	1385.8	7783.4	9169.2	176.1	1209.7	1385.8
HA92YA 852.1	25700	1030	24670			26978	3228	2280	312	18300	2828	23720	33.2	18266.8	3117	15150.6	18267.6	394.9	2722.1	3117

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	**Gross**	**Tare**	**Net**	**+10 Mesh**	**-10 Mesh**	**Gross**	**Tare**	**Archive**	**Head**	**Spiral**	**Flotation**	**Total**	**+10 Mesh**	**-10 Mesh**	**Conc.**	**Reject**	**Total**	**Assay**	**ALRC**	**Total**
HA92YA 852.2	29000	1030	27970			29760	3210	2598	326	20390	3206	26520	26.4	20363.6	3593.2	16754	20347.2	464.9	3128.3	3593.2
HA92YA 852.3	6600	515	6085			7044	1554	506	78	4256	642	5482	29.3	4226.7	541.5	3703.4	4244.9	65.5	476	541.5
HA92YA 853.1	22800	1030	21770			23826	3110	1932	290	16080	2404	20706	0	16080	2083.7	13974.5	16058.2	252.7	1831	2083.7
HA92YA 853.2	7800	515	7285			8450	1546	644	100	5372	768	6884	0	5372	648.9	4722.3	5371.2	79.4	569.5	648.9
HA92YA 854	9500	515	8985			10234	1574	798	114	6720	1022	8654	0	6720	915.6	5799.6	6715.2	119.1	796.5	915.6
HA92YA 855.1	25200	1030	24170			25598	3126	2182	314	17272	2662	22430	227.4	17044.6	1769	15260.3	17029.3	229.5	1539.5	1769
HA92YA 855.2	24500	1030	23470			25156	3178	2152	302	16936	2568	21958	0	16936	1463.4	15337.5	16800.9	186.2	1277.2	1463.4
HA92YA 855.3	22600	1030	21570			23260	3146	1894	244	15630	2326	20094	0	15630	1609.7	13984.9	15594.6	219.1	1390.6	1609.7
HA92YA 855.4	40000	1545	38455			40450	4696	3300	440	27910	4006	35656	0	27910	2876.7	24968.8	27845.5	357.5	2519.2	2876.7
HA92YA 855.5	39000	1545	37455			40940	5358	4352	734	25952	4536	35574	0	25952	2357.5	23550.2	25907.7	293.8	2063.7	2357.5
HA92YA 855.6	16800	515	16285			15734	1632	1680	290	10364	1760	14094	0	10364	995	9339.2	10334.2	116.4	878.6	995
HA92YA 856.1	24900	1030	23870			25984	3168	3284	532	15161	3422	22399	237.9	14923.1	1670.1	13245.5	14915.6	204.4	1465.7	1670.1
HA92YA 856.2	27900	1030	26870			28176	3088	2908	486	18488	3192	25074	44.5	18443.5	2001.2	16432	18433.2	248.8	1752.4	2001.2
HA92YA 856.3	38400	1545	36855			39234	4794	4208	734	25068	4398	34408	26.2	25041.8	2372.3	22586.1	24958.4	313.2	2059.1	2372.3
HA92YA 857.1	26400	1030	25370			27512	3202	2982	494	17764	3052	24292	0	17764	2477.1	15264.7	17741.8	319.1	2158	2477.1
HA92YA 857.2	26200	1030	25170			26854	3112	3652	620	15652	3804	23728	0	15652	1524.8	14067.6	15592.4	191.9	1332.9	1524.8
HA92YA857.3	23200	1030	22170			22064	3068	2304	390	13868	2420	18982	0	13868	900.9	12957.6	13858.5	124.1	776.8	900.9
HA92YA 858	18400	1030	17370			16676	1608	1912	304	10916	1930	15062	0	10916	761.1	10130.7	10891.8	105.1	656	761.1
HA92YA 859.1	22000	1030	20970			23076	3222	2360	370	14620	2480	19830	0	14620	1719.9	12856.6	14576.5	215.1	1504.8	1719.9
HA92YA 859.2	26600	1030	25570			26056	3130	2780	476	16796	2870	22922	52.3	16743.7	1345	15325.2	16670.2	167.5	1177.5	1345
HA92YA 860	13700	515	13185			12098	1576	1296	198	7666	1354	10514	21.1	7644.9	545.4	7038.5	7583.9	78.6	466.8	545.4
HA92YA 861.1	27400	1030	26370			28944	3554	2898	600	18630	3228	25356	0	18630	4661.1	14317.6	18978.7	558.8	4102.3	4661.1
HA92YA 861.2	28500	1030	27470			29384	3208	3086	680	19000	3372	26138	0	19000	2777.2	16209.1	18986.3	340	2437.2	2777.2
HA92YA 861.3	22100	1030	21070			21728	3226	2254	476	13430	2326	18486	0	13430	1244.7	11996	13240.7	162.3	1082.4	1244.7
HA92YA 862.1	24600	1030	23570			25696	3086	2690	576	16394	2926	22586	0	16394	3029.6	13280.1	16309.7	385.1	2644.5	3029.6
HA92YA 862.2	33400	1545	31855			33052	3172	3538	732	21770	3776	29816	0	21770	2282.8	19442.5	21725.3	285.1	1997.7	2282.8
HA92YA 862.3	9900	515	9385			9618	1826	930	150	5686	1028	7794	110.1	5575.9	588	4999.7	5587.7	79.1	508.9	588
HA92YA 863.1	23600	1030	22570			24706	3164	2494	508	15774	2736	21512	8.1	15765.9	1406.3	14328.7	15735	171.3	1235	1406.3
HA92YA 863.2	28700	1030	27670			28676	3110	2582	542	18628	3790	25542	19.4	18608.6	1725.5	17044.2	18769.7	212.9	1512.6	1725.5
HA92YA 864	13400	515	12885			12088	1584	1226	234	7728	1286	10474	17.2	7710.8	724.8	6943.7	7668.5	93.6	631.2	724.8
CH92YA 865.1	14000	515	13485			14504	1596	1570	226	9420	1684	12900	0	9420	1545	7865.8	9410.8	193.3	1351.7	1545
CH92YA 865.2	12000	515	11485			12530	1608	1296	202	8076	1344	10918	0	8076	980.7	6708.3	7689	120.9	859.8	980.7
CH92YA 865.3	12300	515	11785			12912	1554	1348	218	8284	1506	11356	0	8284	2213.6	5900.1	8113.7	279.9	1933.7	2213.6
CH92YA 865.4	10700	515	10185			11138	1602	1250	178	6806	1300	9534	0	6806	1330.3	5468.7	6799	163.3	1167	1330.3

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	Gross	Tare	Net	+10 Mesh	-10 Mesh	Gross	Tare	Archive	Head	Spiral	Flotation	Total	+10 Mesh	-10 Mesh	Conc.	Reject	Total	Assay	ALRC	Total
CH92YA866	16000	515	15485			16414	1602	1768	376	10834	1828	14806	0	10834	7370.7	3422.6	10793.3	925.9	6444.8	7370.7
HA92YA 867.1	22100	1030	21070			23472	3164	2390	416	14980	2506	20292	0	14980	2523.8	12427.8	14951.6	309.5	2214.3	2523.8
HA92YA 867.2	32600	1545	31055			34630	4696	3640	638	21860	3762	29900	0	21860	2706	19125.5	21831.5	333.6	2372.4	2706
HA92YA 867.3	28700	1030	27670			28710	3238	2842	556	18320	3796	25514	0	18320	1982.8	13421.3	15404.1	248	1734.8	1982.8
HA92YA 868.1	22700	1030	21670			24382	3600	2622	498	14948	2692	20760	0	14948	2073.6	12797.4	14871	257.6	1816	2073.6
HA92YA 868.2	25600	1030	24570			24908	3168	2550	468	16060	2644	21722	6.8	16053.2	1230.2	14791.4	16021.6	154.9	1075.3	1230.2
HA92YA 869	13900	515	13385			12874	1564	1332	200	8206	1560	11298	0	8206	842.1	3526.1	4368.2	106.7	735.4	842.1
HA92YA 870	13000	515	12485			11968	1836	1198	216	7452	1254	10120	479.7	6972.3	671.1	6288.8	6959.9	84.8	586.3	671.1
CH92YA 871.1	13700	515	13185			14142	1532	1490	294	9194	1608	12586	5425.3	3768.7	272.6	3661.3	3933.9	34.9	237.7	272.6
CH92YA 871.2	12900	515	12385			13354	1614	1570	242	8528	1570	11910	5207.6	3320.4	380.2	3033.4	3413.6	45.5	334.7	380.2
HA92YA 872	24400	1030	23370			25960	3166	2712	448	16772	2850	22782	57.8	16714.2	2813.1	13801.5	16614.6	356.1	2457	2813.1
HA92YA 873	13500	515	12985			12592	1536	1446	260	7866	1478	11050	12.5	7853.5	563.5	7235.7	7799.2	69.3	494.2	563.5
HA92YA 874	11500	515	10985			10394	1542	1084	184	6466	1114	8848	0	6466	452.8	5955.6	6408.4	55.7	397.1	452.8
HA92YA 875.1	26200	1030	25170			27322	3188	2740	580	17870	2928	24118	26.4	17843.6	1649.8	16124.6	17774.4	204.1	1445.7	1649.8
HA92YA 875.2	24800	1030	23770			25774	3534	2698	436	16302	2790	22226	23.2	16278.8	1622.9	14655.4	16278.3	203.5	1419.4	1622.9
HA92YA 875.3	12200	515	11685			10972	1634	1102	200	6848	1200	9350	3	6845	463.1	6380	6843.1	56.9	406.2	463.1
HA92YA 876.1	26000	1030	24970			27084	3196	2856	476	17470	3072	23874	45	17425	924.2	16342.5	17266.7	113.7	810.5	924.2
HA92YA 876.2	3400	515	2885			4358	1606	328	54	2004	360	2746	0	2004	200.5	1801.7	2002.2	25.5	175	200.5
HA92YA 877.1	23100	1030	22070			24354	3158	2482	384	15632	2648	21146	47.5	15584.5	1558.3	14006.4	15564.7	194.3	1364	1558.3
HA92YA 877.2	21900	1030	20870			21462	3306	2160	308	13374	2316	18158	124.6	13249.4	850.8	12389	13239.8	103.9	746.9	850.8
HA92YA 878.1	21800	1030	20770			23304	3428	2298	358	14660	2540	19856	118.3	14541.7	965.8	13560.9	14526.7	124.2	841.6	965.8
HA92YA 878.2	7600	515	7085			8232	1554	812	120	4894	836	6662	114.9	4779.1	258.5	4465.6	4724.1	35.2	223.3	258.5
HA92YA 879.1	22300	1030	21270			23518	3176	2364	416	14978	2556	20314	0	14978	957	13969.3	14926.3	118.7	838.3	957
HA92YA 879.2	24800	1030	23770			24238	3216	3648	576	12772	3960	20956	2.6	12769.4	1004.4	11749.8	12754.2	124.6	879.8	1004.4
HA92YA 880	12600	515	12085			11656	1600	1198	188	7404	1262	10052	2	7402	456.1	6907.7	7363.8	57.5	398.6	456.1
HA92YA 881	12300	515	11785			12939	1606	1310	212	8422	1388	11332	688.7	7733.3	392	7362.7	7754.7	50.2	341.8	392
HA92YA 882	12200	515	11685			11144	1626	1174	150	6956	1238	9518	0	6956	385.3	6525.5	6910.8	46.4	338.9	385.3
HA92YA 883.1	26100	1030	25070			27358	3262	2856	430	17486	3040	23812	144.9	17341.1	1006.8	16305.8	17312.6	123.6	883.2	1006.8
HA92YA 883.2	28000	1030	26970			27804	3196	2710	490	18360	3032	24592	401.4	17958.6	1072.7	16821.1	17893.8	130.3	942.4	1072.7
HA92YA 884	8000	515	7485			7684	1638	724	110	4410	800	6044	0	4410	355	3969.5	4324.5	45.2	309.8	355
HA92YA 885	14100	515	13585			14668	1646	1436	242	9690	1670	13038	1605	8085	627.4	7480	8107.4	77.4	550	627.4
HA92YA 886.1	24500	1030	23470			25068	3206	2616	430	15968	2824	21838	289	15679	1065.9	14528	15593.9	139.6	926.3	1065.9
HA92YA 886.2	25600	1030	24570			26424	3194	2644	406	17284	2870	23204	59.7	17224.3	1114.1	15962.5	17076.6	133.8	980.3	1114.1
HA92YA 886.3	25200	1030	24170			25818	3206	2574	394	16832	2794	22594	19.5	16812.5	1128.5	15605.8	16734.3	138.3	990.2	1128.5

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	**Gross**	**Tare**	**Net**	**+10 Mesh**	**-10 Mesh**	**Gross**	**Tare**	**Archive**	**Head**	**Spiral**	**Flotation**	**Total**	**+10 Mesh**	**-10 Mesh**	**Conc.**	**Reject**	**Total**	**Assay**	**ALRC**	**Total**
HA92YA 886.4	34200	1545	32655			35286	4830	3458	540	22684	3734	30416	31.8	22652.2	1481.1	20890.1	22371.2	183.8	1297.3	1481.1
HA92YA 886.5	41300	2060	39240			43018	6324	4292	694	27050	4584	36620	89.4	26960.6	1889.1	24765.6	26654.7	248.4	1640.7	1889.1
CH92YA 887	72300	2575	69725			73276	7944	2802	740	48240	3862	55644	39560	8680	891.2	10645.4	11536.6	110.4	780.8	891.2
HA92YA 890.1	22700	1030	21670			23690	3192	2440	416	14984	2646	20486	0.8	14983.2	3596	11276.4	14872.4	451.6	3144.4	3596
HA92YA 890.2	9800	515	9285			9198	1618	744	284	5596	948	7572	6.5	5589.5	357.3	4893.4	5250.7	44.8	312.5	357.3
HA92YA 891.1	24500	1030	23470			25906	3418	2894	424	16620	2810	22748	63.5	16556.5	994	15222.9	16216.9	130.7	863.3	994
HA92YA 891.2	25400	1030	24370			26262	3160	2608	414	17158	2872	23052	47.8	17110.2	907.5	15836.1	16743.6	115.8	791.7	907.5
HA92YA 891.3	14100	515	13585			12842	1620	1144	408	8248	1420	11220	41.7	8206.3	504.6	7477.7	7982.3	61.5	443.1	504.6
GR93GA 1	10800	500	10300			11490	1612	608	578	7550	1138	9874	2368.4	5181.6	1531.8	3702.4	5234.2	189.2	1342.6	1531.8
HA93GA 2	12600	500	12100			13758	1650	762	772	8502	1596	11632	3913.6	4588.4	496.1	4325.1	4821.2	128	368.1	496.1
GR93GA 3	12700	500	12200			13560	1616	770	766	8766	1528	11830	1011	7755	2071.8	5682.3	7754.1	253.9	1817.9	2071.8
HA93GA 4.1	11500	500	11000			12278	1600	678	686	8020	1294	10678	0	8020	3740.1	4259.6	7999.7	468.4	3271.7	3740.1
HA93GA 4.2	13100	500	12600			13666	1530	776	748	9102	1502	12128	2.2	9099.8	3266.4	5819.6	9086	398.8	2867.6	3266.4
HA93GA 4.3	7900	500	7400			8768	1554	426	472	5396	912	7206	0	5396	1313.7	4070.5	5384.2	169.9	1143.8	1313.7
HA93GA 6.1	9400	500	8900			10240	1628	540	538	6492	1034	8604	0	6492	1100.6	5361.1	6461.7	131.5	969.1	1100.6
HA93GA 6.2	8900	500	8400			9600	1532	556	496	5988	1020	8060	0	5988	948.4	5010.7	5959.1	115.6	832.8	948.4
HA93GA 6.3	3700	500	3200			4752	1612	228	210	2306	388	3132	0	2306	303.8	1929.7	2233.5	76.6	227.2	303.8
PC93GA 7	-	-	-										0	93.4	93.4	NONE	93.4	58.5	34.9	93.4
HA93GA 8	11100	500	10600			11794	1596	660	622	7670	1242	10194	466	7204	387.9	6894.7	7282.6	95.3	292.6	387.9
HA93GA 9	8800	500	8300			9614	1602	522	582	5900	1002	8006	218.7	5681.3	280.8	5378.1	5658.9	71.4	209.4	280.8
CH93GA 10	7700	500	7200			8488	1620	432	494	5104	828	6858	530.3	4573.7	599	3971.8	4570.8	72.6	526.4	599
HA93GA 11	12500	500	12000			13322	1556	816	716	8794	1436	11762	54.6	8739.4	3496.3	5214.3	8710.6	439.7	3056.6	3496.3
HG93GA 12	3400	0	3400			4892	1652	242	198	2386	410	3236	0	2386	998.8	1371.7	2370.5	131.5	867.3	998.8
GR93GA 13	8100	500	7600			8948	1570	468	362	5228	902	6960	3418.7	1809.3	381.4	1504.8	1886.2	95	286.4	381.4
GR93GA 15	7200	500	6700			8280	1658	470	384	4972	794	6620	0	4972	1544.8	3411	4955.8	190.3	1354.5	1544.8
PC93GA 16	-	-	-										0	300.7	300.7	NONE	300.7	72.3	228.4	300.7
CH93GA 18	6600	500	6100			7476	1604	338	328	3998	698	5362	1884.1	2113.9	252.1	1603.4	1855.5	59.6	192.5	252.1
HA93GA 20.1	14700	500	14200			14472	1822	864	804	9394	1586	12648	2510.8	6883.2	226.2	6772.7	6998.9	55.4	170.8	226.2
HA93GA 20.2	13600	500	13100			12798	1604	766	698	8346	1360	11170	6793	1553	127	1959.9	2086.9	32.7	94.3	127
HA93GA 21	9700	500	9200			10626	1588	284	354	7810	536	8984	474.6	7335.4	2179.6	5157.1	7336.7	265.3	1914.3	2179.6
CH93GA 22	11500	500	11000			12306	1606	780	678	7944	1300	10702	148.3	7795.7	1012.6	6617.6	7630.2	131.4	881.2	1012.6
HA93GA 23.1	11700	500	11200			13726	1604	832	746	9068	1486	12132	83	8985	744.6	8224.8	8969.4	92.3	652.3	744.6
HA93GA 23.2	13900	500	13400			12498	1604	792	684	8082	1342	10900	16.9	8065.1	1074.3	6988.6	8062.9	139.7	934.6	1074.3
GR93GA 24	10200	500	9700			11382	1650	624	710	7164	1235	9733	112.8	7051.2	604	6436.2	7040.2	74.2	529.8	604

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	Gross	Tare	Net	+10 Mesh	-10 Mesh	Gross	Tare	Archive	Head	Spiral	Flotation	Total	+10 Mesh	-10 Mesh	Conc.	Reject	Total	Assay	ALRC	Total
HA93GA 25	-	-	-			2932	1772	164	148	850	0	1162	218.4	631.6	52.5	547.9	600.4	39.1	13.4	52.5
RK93GA 26	-	-	-			5476	1792	214	274	2764	450	3702	0	2764	777.4	1937	2714.4	99.2	678.2	777.4
CH93GA 27	5600	500	5100			5810	1602	270	304	3056	570	4200	119.4	2936.6	201.6	2395.7	2597.3	50.7	150.9	201.6
HA93GA 28	11400	500	10900			12406	1824	720	722	7824	1310	10576	536.9	7287.1	1243.5	5981.4	7224.9	161	1082.5	1243.5
CH93GA 29.1	11600	500	11100			12408	1644	1020	412	7960	1358	10750	233.1	7726.9	634.5	7073.9	7708.4	79.5	555	634.5
CH93GA 29.2	12700	500	12200			13302	1606	1154	370	8682	1482	11688	1686.9	6995.1	605	6372.8	6977.8	77.1	527.9	605
CH93GA 30	11800	500	11300			13046	1978	1088	396	8156	1422	11062	81.9	8074.1	364.4	7674.4	8038.8	92.3	272.1	364.4
HA93GA 31	8600	500	8100			9188	1588	722	260	5650	966	7598	829.3	4820.7	224.4	4578.2	4802.6	57.2	167.2	224.4
HA93GA 32.1	11200	500	10700			11900	1600	1010	358	7572	1350	10290	0	7572	662.7	6881.1	7543.8	85.2	577.5	662.7
HA93GA 32.2	9800	500	9300			10576	1608	938	273	6632	1122	8965	14.2	6617.8	516.4	6051.4	6567.8	63.2	453.2	516.4
HA93GA 33	3500	500	3000			4456	1602	186	188	2102	370	2846	7.3	2094.7	151.3	1924.6	2075.9	56.5	94.8	151.3
HA93GA 34	11100	500	10600			11768	1566	1044	376	7478	1300	10198	0	7478	717.9	6742.7	7460.6	91.4	626.5	717.9
CH93GA 35	8200	500	7700			9022	1596	750	232	5506	932	7420	56.1	5449.9	419.2	5013.4	5432.6	53.6	365.6	419.2
GR93GA 36	12400	500	11900			13086	1612	1182	464	8442	1376	11464	4908.9	3533.1	138.2	3369.6	3507.8	50.2	88	138.2
HA93GA 37.1	12100	500	11600			12806	1602	1136	412	8218	1430	11196	0	8218	488	7721	8209	60.3	427.7	488
HA93GA 37.2	11500	500	11000			12148	1618	1116	334	7730	1342	10522	11.5	7718.5	480.1	7215.4	7695.5	60.2	419.9	480.1
HA93GA 37.3	9500	500	9000			10288	1628	864	330	6358	1104	8656	0	6358	389.9	5947.9	6337.8	99.5	290.4	389.9
HA93GA 38.1	11100	500	10600			11856	1620	972	362	7544	1348	10226	0	7544	394.3	7121.8	7516.1	98.2	296.1	394.3
HA93GA 38.2	9200	500	8700			9822	1650	800	260	6034	1074	8168	8.4	6025.6	352.3	5565.7	5918	92.1	260.2	352.3
HA93GA 39.1	10500	500	10000			11170	1606	984	282	7036	1234	9536	0	7036	486.6	6514.2	7000.8	60.9	425.7	486.6
HA93GA 39.2	10200	500	9700			10630	1556	900	322	6728	1116	9066	0	6728	387.6	6331.5	6719.1	96.4	291.2	387.6
HA93GA 40	9300	500	8800			8784	1624	676	218	5382	878	7154	0	5382	382.8	4966.1	5348.9	95.2	287.6	382.8
HA93GA 41	8500	500	8000			9280	1600	780	268	5668	958	7674	0	5668	381.5	5285.9	5667.4	94.7	286.8	381.5
HA93GA 42	7100	500	6600			7874	1530	586	210	4688	858	6342	0	4688	225.2	4451.1	4676.3	56.2	169	225.2
HA93GA 43	7800	500	7300			8448	1532	704	234	5130	850	6918	0	5130	222.3	4899.8	5122.1	54.4	167.9	222.3
HA93GA 44	6600	500	6100			7438	1604	618	188	4286	738	5830	0	4286	229.4	4052.9	4282.3	57.1	172.3	229.4
CH93GA 45	6100	500	5600										0	5600	217.9	3851.8	4069.7	55.9	162	217.9
HA93GA46	8200	500	7700			9062	1644	720	272	5472	950	7414	0	5472	406.5	5054.5	5461	100.8	305.7	406.5
HA93GA 47	7200	500	6700			7154	1600	562	178	4064	742	5546	4.8	4059.2	280.4	3777.1	4057.5	70.1	210.3	280.4
HA93GA 48	6600	500	6100			7492	1614	606	252	4288	736	5882	0	4288	279.9	3974.8	4254.7	71.2	208.7	279.9
GR93GA 49	6800	500	6300			7190	1636	308	342	3692	620	4962	1213.9	2478.1	375.5	1946.6	2322.1	94.3	281.2	375.5
HA93GA 50	9200	500	8700			9720	1602	834	264	6066	986	8150	2408.4	3657.6	238.2	3410.3	3648.5	59.6	178.6	238.2
HA93GA 51.1	8600	500	8100			9206	1568	764	266	5620	990	7640	0	5620	359.1	5236.3	5595.4	88	271.1	359.1
HA93GA 51.2	9500	500	9000			10182	1616	814	326	6350	1072	8562	0	6350	436.6	5862.1	6298.7	109.7	326.9	436.6

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	Gross	Tare	Net	+10 Mesh	-10 Mesh	Gross	Tare	Archive	Head	Spiral	Flotation	Total	+10 Mesh	-10 Mesh	Conc.	Reject	Total	Assay	ALRC	Total
HA93GA 51.3	11500	500	11000			12032	1558	1028	360	7678	1400	10466	0	7678	635.7	6987	7622.7	78.3	557.4	635.7
HA93GA 51.4	3700	500	3200			4642	1596	586	230	2230	0	3046	0	2230	252.1	1960.7	2212.8	62.6	189.5	252.1
HA93GA 52	3900	500	3400			4014	1594	298	320	1796	0	2414	1.1	1794.9	209.4	1561.3	1770.7	51.6	157.8	209.4
HA93GA 53	3200	500	2700			3410	1624	334	118	1318	0	1770	224.4	1093.6	72.5	998.5	1071	45.4	27.1	72.5
RS93GA 54	10400	500	9900			10940	1632	806	452	6568	1012	8838	4044.3	2523.7	150.6	2330.1	2480.7	55.8	94.8	150.6
PC93GA 55	-	-	-										0	62.5	62.5	NONE	62.5	54.6	7.9	62.5
HA93GA 56.1	10400	500	9900			10968	1612	916	364	6886	1194	9360	2.9	6883.1	591.6	6249.7	6841.3	74.2	517.4	591.6
HA93GA 56.2	11900	500	11400			12346	1590	1260	206	7954	1328	10748	0.8	7953.2	722.9	7171.3	7894.2	90.7	632.2	722.9
GR93GA 57	12100	500	11600			12340	1618	932	300	7786	1224	10242	3403.1	4382.9	249.8	3955.7	4205.5	62.6	187.2	249.8
RS93GA 58	10900	500	10400			9562	1608	802	286	5834	950	7872	114.9	5719.1	308.3	5329.9	5638.2	74.8	233.5	308.3
HA93GA 59.1	3900	500	3400			4558	1620	276	118	2182	348	2924	0	2182	245.7	1911.8	2157.5	60.2	185.5	245.7
HA93GA 59.2	6800	500	6300			6634	1576	498	164	3754	640	5056	0	3754	758	2960.8	3718.8	96.5	661.5	758
RSGA93 60	10800	500	10300			11120	1554	920	292	7088	1274	9574	2762.1	4325.9	291.9	4006.3	4298.2	74	217.9	291.9
HA93GA 61	7100	500	6600			6730	1620	598	100	3762	630	5090	0	3762	340.8	3342.7	3683.5	82.8	258	340.8
GR93GA 62	9300	500	8800			9520	1544	718	224	5562	976	7480	2698.7	2863.3	184.5	2650.4	2834.9	68.6	115.9	184.5
HA93GA 63	10200	500	9700			10768	1612	856	320	6826	1144	9146	2378.2	4447.8	231.1	4185.2	4416.3	58.2	172.9	231.1
GR93GA 64	11900	500	11400			12652	1536	874	306	6700	1116	8996	3550.2	3149.8	131.9	3012.7	3144.6	49.4	82.5	131.9
CH93GA 65	13500	500	13000			14086	1634	1110	370	9392	1362	12234	2595.3	6796.7	497.5	6247.6	6745.1	62.2	435.3	497.5
HA93GA 66	10100	500	9600			10794	1650	306	890	6768	1176	9140	1129.6	5638.4	443.7	5192.2	5635.9	55.1	388.6	443.7
HA93GA 67	9400	500	8900			8778	1558	790	128	5414	890	7222	0	5414	633.5	4710.8	5344.3	80	553.5	633.5
HA93GA 68	4800	500	4300										0	1504.8	53.5	1451.3	1504.8	40.1	13.4	53.5
HA93GA 69	3200	500	2700			4994	1604	272	92	2622	390	3376	0	2622	202.6	2078.3	2280.9	50	152.6	202.6
HA93GA 70	12800	500	12300			12800	1602	1118	356	8300	1412	11186	0	8300	628.6	7553.1	8181.7	81.6	547	628.6
HA93GA 71	11000	500	10500			11556	1604	1142	210	7368	1226	9946	0	7368	686.8	6659.3	7346.1	82.6	604.2	686.8
HA93GA 72	7600	500	7100			8042	1596	576	214	4776	878	6444	0	4776	322.5	4442.5	4765	81.1	241.4	322.5
HA93GA 73	7300	500	6800			7288	1554	562	196	4238	734	5730	0	4238	278	3916.1	4194.1	69.4	208.6	278
HA93GA 74	6300	500	5800			7006	1620	500	184	4008	692	5384	0	4008	286.5	3673.9	3960.4	71.9	214.6	286.5
RS93GA 75	13400	500	12900			14370	1632	1388	196	9144	1622	12350	7338.3	1805.7	103.9	1671.7	1775.6	51.3	52.6	103.9
RS93GA 76	12200	500	11700			12840	1536	1078	386	8560	1270	11294	5560.2	2999.8	160.7	2825.7	2986.4	60.8	99.9	160.7
RS93GA 77	13700	500	13200			14116	1602	980	192	8588	1348	11108	6153.8	2434.2	155.6	2189.2	2344.8	57	98.6	155.6
RS93GA 78	12900	500	12400			13518	1552	1216	278	9036	1412	11942	6639.3	2396.7	155	2196.2	2351.2	53.1	101.9	155
HA93GA 79	4400	500	3900			4380	1618	190	182	2048	330	2750	676.6	1371.4	258.3	1074.6	1332.9	65	193.3	258.3
HA93GA 80	8400	500	7900			9090	1574	884	138	5540	952	7514	19.5	5520.5	278	5116.8	5394.8	92.4	185.6	278
HA93GA 81	11700	500	11200			12378	1624	1036	366	8034	1310	10746	2823.8	5210.2	262.5	4937.9	5200.4	64	198.5	262.5

See Appendix A for map numbers.

Appendix B. -- Sample preparation and spiral concentration spreadsheet (grams)

	Sample as received, wet			Screened products, dry				Jones splits					Spiral feed		Spiral products			Concentrate splits		
Sample	**Gross**	**Tare**	**Net**	**+10 Mesh**	**-10 Mesh**	**Gross**	**Tare**	**Archive**	**Head**	**Spiral**	**Flotation**	**Total**	**+10 Mesh**	**-10 Mesh**	**Conc.**	**Reject**	**Total**	**Assay**	**ALRC**	**Total**
HA93GA 82	7500	500	7000			8134	1600	632	228	4878	796	6534	28.9	4849.1	242.3	4590.2	4832.5	59.8	182.5	242.3
GR93GA 83	9800	500	9300			10682	1622	818	278	6024	1124	8244	481.3	5542.7	259.7	5273.4	5533.1	65.4	194.3	259.7

See Appendix A for map numbers.

Appendix C. -- Mineral data for characterized samples

Sample Number	WT % Conc.	Recovered heavy minerals in bulk sample							ILM+ZIR+RUT % in bulk sample
		MAG %	ILM %	GAR %	ZIR %	MON %	RUT %	OTH %	
Cape Yakataga area									
RS93GA 076	1.77	0.001	0.034	0.061	0.001	0.000	0.002	1.67	0.037
RS93GA 075	1.06	0.000	0.030	0.021	0.000	0.000	0.001	1.01	0.031
RS93GA 077	1.63	0.001	0.019	0.003	0.000	0.000	0.000	1.60	0.020
HA93GA 073	6.54	0.004	0.231	0.002	0.000	0.000	0.002	6.30	0.233
HA93GA 070	7.48	0.049	0.325	1.038	0.000	0.000	0.035	6.03	0.360
HA93GA 072	6.73	0.015	0.301	0.137	0.001	0.000	0.002	6.28	0.305
HA93GA 074	7.06	0.013	0.223	0.040	0.000	0.000	0.002	6.78	0.224
HA93GA 071	8.57	0.083	0.568	0.851	0.002	0.000	0.040	7.03	0.609
HA92YK 111	4.79	0.051	0.236	2.519	0.032	0.000	0.053	1.90	0.320
CH92YK 113	4.26	0.017	0.129	0.974	0.005	0.000	0.032	3.11	0.166
HA92YK 123	7.47	0.001	0.186	0.063	0.000	0.000	0.002	7.22	0.189
CH92YK 029.1	6.72	0.031	0.232	0.629	0.011	0.000	0.010	5.80	0.254
CH92YK 029.2	4.83	0.030	0.157	0.193	0.000	0.000	0.001	4.45	0.158
HA92YK 145	5.04	0.011	0.115	0.234	0.007	0.000	0.032	4.64	0.154
CH92YK 148	3.91	0.006	0.106	0.463	0.002	0.000	0.013	3.32	0.121
CH92YK 155	8.42	0.008	0.319	0.706	0.041	0.000	0.122	7.22	0.482
CH92YK 164	12.28	0.035	1.220	1.629	0.035	0.000	0.155	9.20	1.409
CH92YK 166	15.95	0.437	2.310	4.780	0.335	0.000	0.271	7.82	2.916
CH92YK 170.1	18.20	0.213	1.592	3.534	0.210	0.000	0.269	12.38	2.071
CH92YK 170.3	11.02	0.011	0.250	0.089	0.010	0.000	0.008	10.65	0.268
CH92YK 174	10.26	0.063	0.488	0.631	0.040	0.000	0.052	8.98	0.580
HA93GA 180	12.28	0.004	1.053	0.092	0.008	0.000	0.007	11.12	1.068
HA93GA 080	4.95	0.066	0.767	0.073	0.001	0.000	0.009	4.04	0.777
HA93GA 082	4.95	0.340	0.853	0.655	0.002	0.000	0.032	3.07	0.887
Minimum	1.06	0.00	0.02	0.00	0.00	0.00	0.00	1.01	0.02
Mean	7.34	0.06	0.49	0.81	0.03	0.00	0.05	5.90	0.57
Maximum	18.20	0.44	2.31	4.78	0.33	0.00	0.27	12.38	2.92
Standard deviation	4.28	0.11	0.56	1.21	0.08	0.00	0.08	3.15	0.70
Yakutat area									
HA93GA 063	3.38	0.103	0.213	0.184	0.000	0.000	0.001	2.88	0.214
HA93GA 066	6.84	0.071	0.504	0.490	0.001	0.000	0.007	5.77	0.511
GR93GA 062	2.94	0.065	0.452	0.014	0.000	0.000	0.001	2.41	0.453
GR93GA 057	2.89	0.015	0.289	0.078	0.000	0.000	0.000	2.51	0.289
PA92YA 705.4	10.83	0.196	0.261	0.343	0.000	0.000	0.000	10.03	0.261
HA92YA 812.1	14.11	1.688	2.183	2.476	0.018	0.000	0.128	7.61	2.330
HA92YA 803.1	15.08	1.502	1.905	2.015	0.018	0.000	0.165	9.47	2.088
HA92YA 802	18.40	4.961	4.261	3.321	0.180	0.000	0.120	5.56	4.561
HA92YA 827.1	27.59	7.375	7.620	4.363	0.215	0.000	0.154	7.87	7.989
PA92YA 701.1	17.78	1.607	3.793	3.240	0.000	0.000	0.132	9.01	3.925
HA92YA 849	46.23	22.411	14.271	4.824	0.352	0.000	0.151	4.22	14.773
HA92YA 829.1	21.55	3.812	5.624	2.974	0.162	0.000	0.162	8.81	5.948
HA92YA 059.1	7.62	0.018	1.331	0.177	0.002	0.000	0.003	6.08	1.335
PA92YA 707.1	18.35	3.516	3.612	2.201	0.000	0.000	0.167	8.85	3.779
PA92YA 707.2	8.54	0.437	1.137	0.812	0.000	0.000	0.050	6.11	1.187
HA92YA 834.2	27.48	2.174	5.027	5.366	0.102	0.000	0.442	14.37	5.570
PA92YA 715.2	8.65	0.148	0.763	0.455	0.000	0.000	0.049	7.23	0.812

Appendix C. -- Mineral data for characterized samples

Sample Number	WT % Conc.	Recovered heavy minerals in bulk sample							ILM+ZIR+RUT % in bulk sample
		MAG %	ILM %	GAR %	ZIR %	MON %	RUT %	OTH %	
PA92YA 715.3	6.58	0.069	0.612	0.247	0.000	0.000	0.030	5.62	0.642
PA92YA 708.1	18.05	3.153	3.008	3.132	0.000	0.000	0.145	8.61	3.153
HA92YA 837.2	17.45	0.696	3.032	1.715	0.025	0.000	0.124	11.85	3.181
HA92YA 862.1	18.52	3.541	6.632	2.576	0.086	0.000	0.064	5.62	6.782
CH92YA 865.3	27.03	2.300	4.524	5.061	0.038	0.000	0.307	14.80	4.869
Minimum	2.89	0.01	0.21	0.01	0.00	0.00	0.00	2.41	0.21
Mean	15.72	2.72	3.23	2.09	0.05	0.00	0.11	7.51	3.39
Maximum	46.23	22.41	14.27	5.37	0.35	0.00	0.44	14.80	14.77
Standard deviation	10.34	4.81	3.31	1.78	0.09	0.00	0.11	3.36	3.45
Mt. Fairweather area									
RS93GA 060	3.86	0.131	0.724	0.176	0.001	0.000	0.002	2.82	0.727
HA93GA 069	5.65	0.006	0.836	0.057	0.000	0.000	0.001	4.75	0.836
HA93GA 046	7.38	1.070	1.553	0.437	0.002	0.000	0.016	4.30	1.571
HA93GA 050	3.87	0.108	0.547	0.056	0.001	0.000	0.002	3.16	0.549
HA93GA 067	8.64	0.081	1.335	0.032	0.000	0.000	0.002	7.19	1.337
HA93GA 052	11.44	0.063	2.398	0.408	0.001	0.000	0.001	8.57	2.399
HA93GA 042	4.70	0.242	0.961	0.033	0.000	0.000	0.004	3.46	0.966
HA93GA 051.1	6.33	0.596	1.505	0.444	0.002	0.000	0.007	3.78	1.513
HA93GA 053	3.69	0.000	0.019	0.009	0.000	0.000	0.000	3.66	0.019
HA93GA 041	6.64	1.032	1.433	0.373	0.001	0.000	0.004	3.79	1.437
RS93GA 054	2.15	0.000	0.030	0.041	0.000	0.000	0.000	2.08	0.030
HA93GA 039.1	6.87	0.863	1.620	0.698	0.003	0.000	0.017	3.66	1.641
CH93GA 030	4.44	0.496	0.568	0.487	0.002	0.000	0.003	2.88	0.572
HA93GA 056.1	8.50	0.175	1.286	1.721	0.001	0.000	0.021	5.30	1.308
HA93GA 037.1	5.91	0.130	0.734	0.933	0.000	0.000	0.017	4.10	0.752
HA93GA 034	9.63	0.555	1.916	2.741	0.001	0.000	0.020	4.40	1.936
HA93GA 032.1	8.72	0.782	2.123	2.676	0.001	0.000	0.016	3.12	2.140
CH93GA 029.1	7.88	0.243	2.137	2.491	0.001	0.000	0.010	3.00	2.147
HA93GA 028	15.89	0.262	3.194	4.147	0.001	0.000	0.014	8.27	3.209
GR93GA 024.1	8.43	0.145	1.434	3.372	0.000	0.000	0.005	3.48	1.439
HA93GA 023.1	8.14	0.165	1.855	1.480	0.000	0.000	0.006	4.63	1.861
RK93GA 026	26.56	0.044	1.141	0.022	0.000	0.000	0.005	25.35	1.146
HA93GA 025	5.28	0.028	0.321	0.011	0.000	0.000	0.000	4.92	0.321
CH93GA 022	12.77	0.349	3.649	2.084	0.000	0.000	0.012	6.68	3.661
HA93GA 021	27.82	1.278	14.250	6.907	0.010	0.000	0.005	5.37	14.264
HA93GA 020.1	2.37	0.001	0.231	0.030	0.000	0.000	0.000	2.11	0.231
GR93GA 003	21.59	0.082	5.620	0.108	0.000	0.000	0.001	15.78	5.621
HA93GA 006.1	16.86	0.199	8.360	0.594	0.000	0.000	0.000	7.71	8.361
HA93GA 004.1	46.52	2.481	7.162	10.095	0.000	0.000	0.001	26.78	7.163
GR93GA 015	31.02	0.681	3.817	12.636	0.024	0.000	0.014	13.85	3.856
Minimum	2.15	0.00	0.02	0.01	0.00	0.00	0.00	2.08	0.02
Mean	11.32	0.41	2.43	1.84	0.00	0.00	0.01	6.63	2.43
Maximum	46.52	2.48	14.25	12.64	0.02	0.00	0.02	26.78	14.26
Standard deviation	10.09	0.53	2.99	3.05	0.00	0.00	0.01	6.14	2.99

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Al_2O_3 %	CaO %	Cr_2O_3 %	Fe_2O_3 %	K_2O %	MgO %	MnO %	Na_2O %	P_2O_5 %	SiO_2 %	TiO_2 %	LOI %	Total	Ba ppm
	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	%	XRF
PA92YK 004.1 1	9.34	8.50	0.90	34.40	0.12	3.43	0.36	1.20	0.14	31.7	9.62	<0.62	99.1	<100
PA92YK 004.1 2	18.00	4.39	0.34	29.00	0.04	3.69	3.31	0.29	0.09	36.3	4.58	0.31	100.3	<100
PA92YK 004.1 3	16.50	14.50	0.10	9.89	0.22	4.29	0.23	1.27	0.11	44.7	1.45	2.31	95.6	<100
PA92YK 004.1 4	17.10	8.78	<0.01	3.51	0.84	1.33	0.12	2.91	0.11	56.9	2.26	1.54	95.4	213
PA92YK 004.1 5	14.10	6.09	<0.01	1.09	0.92	0.48	0.07	3.13	0.09	64.9	4.16	1.23	96.3	244
PA92YK 004.1 6	6.62	1.85	<0.01	0.10	0.47	0.11	0.14	2.29	0.08	83.3	0.05	0.46	95.5	198
CH92YK 010 1	12.10	9.90	0.27	17.00	0.29	4.17	0.26	2.15	0.18	43.2	4.56	0.92	95.0	<100
CH92YK 010 2	19.20	4.03	0.27	27.00	0.07	3.54	3.47	0.33	0.09	38.5	0.98	0.46	97.9	<100
CH92YK 010 3	16.10	13.10	0.13	9.74	0.27	4.38	0.24	1.75	0.12	48.9	1.16	1.85	97.7	<100
CH92YK 010 4	16.20	7.40	<0.01	3.29	0.84	1.30	0.11	3.08	0.11	62.2	0.74	2.00	97.3	292
CH92YK 010 5	13.50	5.16	<0.01	1.20	1.09	0.55	0.07	3.14	0.07	70.2	0.78	1.85	97.6	373
CH92YK 010 6	6.75	1.91	<0.01	<0.01	0.54	0.03	0.05	2.01	0.04	87.4	<0.01	1.08	99.8	220
PA92YK 027.1 1	10.80	10.90	0.44	25.60	0.14	4.73	0.32	1.42	0.15	37.4	7.59	0.77	100.3	<100
PA92YK 027.1 2	14.20	7.99	0.17	23.90	0.13	5.27	1.79	0.63	0.11	37.1	8.97	0.46	100.7	<100
PA92YK 027.1 3	16.50	13.30	0.09	12.90	0.27	5.07	0.55	1.08	0.10	43.9	2.04	2.31	98.1	<100
PA92YK 027.1 4	16.60	8.28	<0.01	3.03	1.12	1.17	0.09	2.84	0.11	59.0	3.97	2.31	98.5	427
PA92YK 027.1 5	14.20	4.67	<0.01	0.84	1.49	0.40	0.05	3.49	0.16	69.1	3.43	1.85	99.7	728
PA92YK 027.1 6	8.70	2.21	<0.01	0.10	0.95	0.08	0.08	2.65	0.18	82.5	0.04	1.23	98.7	562
PA92YK 028.4 1	11.80	10.90	0.19	18.10	0.22	4.92	0.27	1.89	0.18	42.4	5.11	0.77	96.7	<100
PA92YK 028.4 2	14.50	8.83	0.14	20.80	0.17	5.53	1.42	0.92	0.12	40.9	5.41	1.38	100.1	<100
PA92YK 028.4 3	16.40	13.50	0.05	10.70	0.29	5.34	0.25	1.56	0.12	48.5	1.49	2.00	100.2	<100
PA92YK 028.4 4	16.70	7.33	<0.01	3.34	0.91	1.38	0.12	3.33	0.13	62.2	1.73	1.69	98.9	339
PA92YK 028.4 5	14.40	5.37	<0.01	0.95	0.92	0.54	0.07	3.53	0.13	71.3	1.83	1.23	100.3	494
PA92YK 028.4 6	7.39	1.99	<0.01	0.04	0.48	0.06	0.05	2.18	0.08	87.5	0.01	0.31	100.1	227
HA92YK 106 1	6.48	6.04	1.55	46.00	0.08	2.37	0.39	0.76	0.10	20.4	11.70	<0.92	94.9	<100
HA92YK 106 2	18.10	3.64	0.42	29.40	0.04	3.42	3.50	0.21	0.08	35.0	4.26	<0.46	97.6	<100
HA92YK 106 3	17.50	16.20	0.17	10.40	0.14	4.18	0.25	1.04	0.10	43.9	1.63	1.54	97.1	<100
HA92YK 106 4	18.30	11.80	<0.01	3.56	0.55	1.32	0.12	2.42	0.10	51.9	4.06	2.77	96.9	104
HA92YK 106 5	14.50	8.24	0.02	0.96	0.71	0.53	0.09	2.71	0.11	54.8	11.40	1.08	95.1	<100
HA92YK 106 6	5.72	1.64	<0.01	0.02	0.36	0.42	0.43	3.18	0.14	66.9	0.13	0.15	79.1	304
HA92YK 107 1	6.48	6.34	1.32	43.10	0.08	2.40	0.38	0.81	0.10	20.8	11.70	<0.15	93.4	<100
HA92YK 107 2	18.70	3.69	0.38	30.00	0.03	3.51	3.61	0.17	0.08	35.9	4.22	<0.31	100.0	<100
HA92YK 107 3	17.30	15.90	0.20	10.30	0.15	4.11	0.22	0.94	0.10	42.6	1.65	2.46	95.9	<100

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Al_2O_3 %	CaO %	Cr_2O_3 %	Fe_2O_3 %	K_2O %	MgO %	MnO %	Na_2O %	P_2O_5 %	SiO_2 %	TiO_2 %	LOI %	Total	Ba ppm
	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	%	XRF
HA92YK 107 4	18.20	11.70	<0.01	3.23	0.56	1.34	0.12	2.40	0.10	51.9	4.85	3.08	97.5	138
HA92YK 107 5	14.10	7.87	0.02	0.88	0.70	0.51	0.09	2.65	0.12	54.3	11.50	2.15	94.9	103
HA92YK 107 6	6.38	1.79	<0.01	0.08	0.37	0.37	0.36	3.05	0.14	72.9	0.17	1.38	87.0	254
HA92YK 108 1	11.20	10.10	0.30	20.40	0.22	4.41	0.28	1.88	0.17	40.4	5.76	0.77	95.9	<100
HA92YK 108 2	16.10	7.19	0.20	23.50	0.13	4.52	2.13	0.71	0.11	40.0	4.79	0.92	100.3	<100
HA92YK 108 3	16.10	13.70	0.07	10.20	0.27	4.93	0.22	1.56	0.12	46.5	1.39	2.15	97.2	<100
HA92YK 108 4	17.40	8.49	<0.01	3.75	0.80	1.47	0.11	3.04	0.12	61.3	1.49	1.38	99.3	296
HA92YK 108 5	14.70	5.85	<0.01	0.97	1.03	0.49	0.07	3.56	0.10	68.6	1.91	1.54	98.8	391
HA92YK 108 6	7.44	2.12	<0.01	0.07	0.53	0.13	0.06	2.31	0.06	86.0	0.03	0.62	99.4	291
HA92YK 109 1	7.69	7.46	1.25	40.00	0.10	2.87	0.38	0.96	0.11	25.0	11.00	<0.92	95.9	<100
HA92YK 109 2	17.60	4.30	0.36	29.00	0.04	3.58	3.29	0.21	0.09	35.1	5.53	<0.31	98.8	<100
HA92YK 109 3	17.40	16.40	0.16	10.50	0.12	4.38	0.24	0.94	0.10	43.2	1.66	2.15	97.3	<100
HA92YK 109 4	19.10	13.30	<0.01	3.52	0.46	1.31	0.12	2.10	0.10	48.9	4.83	2.62	96.4	<100
HA92YK 109 5	15.60	10.20	0.02	1.04	0.56	0.53	0.09	2.43	0.15	49.5	13.00	1.38	94.5	<100
HA92YK 109 6	6.69	2.08	<0.01	0.04	0.36	0.40	0.41	3.26	0.19	66.5	0.18	0.15	80.3	345
HA92YK 125 1	13.00	10.30	0.07	13.30	0.34	4.73	0.23	2.51	0.21	48.0	3.04	1.54	97.3	<100
HA92YK 125 2	16.20	7.97	0.10	18.30	0.26	4.09	1.70	1.19	0.13	44.5	1.97	0.62	97.0	<100
HA92YK 125 3	15.70	12.20	0.06	10.10	0.33	4.69	0.29	1.83	0.13	48.9	1.24	1.54	97.0	<100
HA92YK 125 4	15.50	6.39	<0.01	3.54	0.98	1.44	0.10	3.33	0.12	63.2	0.67	2.31	97.6	389
HA92YK 125 5	13.20	4.41	<0.01	1.06	1.12	0.50	0.07	3.37	0.07	74.7	0.47	1.23	100.2	524
HA92YK 125 6	6.22	1.67	<0.01	0.05	0.55	0.07	0.04	1.89	0.04	88.7	<0.01	0.92	100.2	279
CH92YK 128 1	12.60	10.70	0.17	17.20	0.25	4.79	0.27	2.01	0.20	46.1	4.71	1.08	100.1	<100
CH92YK 128 2	17.50	6.75	0.22	22.80	0.17	4.37	2.35	0.70	0.11	41.9	2.05	0.77	99.7	<100
CH92YK 128 3	16.30	12.80	0.05	9.66	0.35	4.62	0.21	1.79	0.13	49.5	1.21	2.31	98.9	<100
CH92YK 128 4	15.60	12.70	0.04	9.79	0.34	5.72	0.26	3.14	0.11	49.3	1.17	2.31	100.5	NSS
CH92YK 128 5	15.80	6.20	0.01	3.42	1.00	1.43	0.11	3.32	0.12	64.7	0.82	2.00	98.9	406
CH92YK 128 6	12.80	3.89	<0.01	0.88	1.16	0.42	0.07	3.50	0.07	73.9	0.67	0.77	98.1	513
CH92YK 137.2 1	6.37	1.65	<0.01	0.08	0.50	0.04	0.05	1.86	0.04	88.9	<0.01	0.62	100.1	282
CH92YK 137.2 2	11.10	9.19	0.36	21.30	0.25	4.04	0.30	1.85	0.17	39.7	6.44	0.46	95.2	<100
CH92YK 137.2 3	18.70	4.56	0.24	26.70	0.10	3.85	3.13	0.41	0.10	39.5	1.73	0.31	99.3	<100
CH92YK 137.2 4	15.90	12.00	0.09	10.10	0.38	4.56	0.29	1.75	0.13	48.0	1.22	1.54	96.0	<100
CH92YK 137.2 5	15.60	5.95	<0.01	3.58	1.03	1.50	0.11	3.37	0.12	64.4	0.82	1.54	98.0	442
CH92YK 137.2 6	12.80	3.83	<0.01	1.05	1.18	0.47	0.06	3.46	0.07	73.9	0.73	0.46	98.0	512

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Al_2O_3 %	CaO %	Cr_2O_3 %	Fe_2O_3 %	K_2O %	MgO %	MnO %	Na_2O %	P_2O_5 %	SiO_2 %	TiO_2 %	LOI %	Total	Ba ppm
	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	%	XRF
HA92YK 144 1	6.37	1.58	<0.01	0.09	0.56	0.06	0.05	2.04	0.04	88.4	<0.01	0.62	99.8	335
HA92YK 144 2	12.80	9.72	0.14	14.70	0.35	4.71	0.24	2.58	0.21	47.7	3.70	1.08	97.9	<100
HA92YK 144 3	15.90	7.58	0.12	19.50	0.30	4.38	1.64	1.29	0.14	45.2	3.29	0.92	100.3	<100
HA92YK 144 4	15.70	10.60	0.05	10.10	0.50	4.76	0.31	2.10	0.14	50.2	1.28	2.46	98.2	<100
HA92YK 144 5	15.20	5.29	<0.01	3.57	1.01	1.59	0.11	3.46	0.13	67.7	0.76	1.38	100.2	481
HA92YK 144 6	12.80	3.67	<0.01	0.97	1.11	0.52	0.07	3.56	0.08	75.8	0.49	0.92	100.0	595
CH92YK 162 1	6.40	1.58	<0.01	0.05	0.61	0.04	0.04	2.07	0.04	89.1	0.01	0.31	100.3	276
CH92YK 162 2	10.20	9.93	0.42	24.10	0.16	4.69	0.32	1.42	0.15	36.3	7.31	0.00	95.0	<100
CH92YK 162 3	15.70	6.54	0.24	25.00	0.09	5.12	2.22	0.53	0.10	37.9	5.44	0.00	98.9	<100
CH92YK 162 4	16.30	14.70	0.08	10.80	0.20	5.78	0.23	1.25	0.11	46.1	1.51	1.69	98.8	<100
CH92YK 162 5	17.40	9.17	<0.01	3.35	0.79	1.46	0.11	2.92	0.12	57.6	2.83	1.69	97.4	299
CH92YK 162 6	14.40	6.28	<0.01	0.94	0.93	0.50	0.06	3.22	0.13	65.8	5.03	0.92	98.2	329
CH92YK 168.1 1	7.18	1.98	<0.01	0.09	0.50	0.07	0.09	2.26	0.09	86.0	0.05	0.31	98.6	<100
CH92YK 168.1 2	8.24	11.80	0.69	24.40	0.05	5.78	0.76	2.34	0.13	22.0	20.20	0.77	97.2	NSS
CH92YK 168.1 3	15.00	5.56	0.33	25.90	0.07	4.06	2.41	0.49	0.09	34.0	8.03	0.00	95.9	<100
CH92YK 168.1 4	16.10	14.80	0.11	10.60	0.18	5.51	0.22	1.12	0.10	44.1	1.63	1.85	96.3	<100
CH92YK 168.1 5	13.50	6.71	<0.01	0.82	0.84	0.42	0.07	3.04	0.20	60.3	8.41	1.69	96.0	239
CH92YK 168.1 6	7.16	2.04	<0.01	0.06	0.49	0.17	0.18	2.63	0.20	78.3	0.08	1.23	92.5	322
CH92YK 172 1	10.70	9.71	0.44	22.50	0.20	4.54	0.30	1.86	0.17	39.4	6.59	0.77	97.2	<100
CH92YK 172 2	14.30	7.02	0.21	23.20	0.14	4.45	1.89	0.78	0.11	37.0	7.70	0.31	97.1	<100
CH92YK 172 3	15.80	12.70	0.08	11.30	0.29	5.42	0.35	1.49	0.12	47.0	1.64	1.85	98.0	<100
CH92YK 172 4	16.10	6.61	<0.01	3.99	0.99	1.68	0.11	3.15	0.14	61.9	1.62	2.46	98.8	337
CH92YK 172 5	13.40	4.31	<0.01	1.53	1.09	0.62	0.07	3.63	0.11	69.6	1.66	1.23	97.2	491
CH92YK 172 6	6.67	1.70	<0.01	0.35	0.55	0.11	0.08	2.23	0.07	86.1	0.11	0.92	98.9	318
HA92YK 181 1	11.20	10.90	0.26	20.80	0.19	4.72	0.29	1.75	0.17	39.7	5.94	1.38	97.3	<100
HA92YK 181 2	13.80	8.28	0.16	22.60	0.14	5.19	1.60	0.70	0.12	37.4	6.31	1.69	98.0	<100
HA92YK 181 3	15.90	14.80	0.06	10.60	0.19	5.35	0.22	1.27	0.10	44.5	1.48	2.31	96.8	<100
HA92YK 181 4	18.00	11.10	<0.01	3.84	0.67	1.53	0.12	2.49	0.13	53.3	3.05	1.85	96.1	193
HA92YK 181 5	15.70	8.36	<0.01	1.00	0.85	0.51	0.07	3.17	0.26	60.4	4.39	1.54	96.3	261
HA92YK 181 6	8.73	2.93	<0.01	0.05	0.50	0.07	0.07	2.60	0.24	84.0	0.08	0.15	99.4	280
CH92YK 187 1	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
CH92YK 187 2	15.70	7.03	0.13	18.90	0.39	4.53	1.44	1.34	0.15	45.5	3.17	2.31	100.6	137
CH92YK 187 3	15.30	9.31	0.04	9.53	0.65	4.70	0.22	2.16	0.14	51.1	1.28	2.77	97.2	171

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Al_2O_3 %	CaO %	Cr_2O_3 %	Fe_2O_3 %	K_2O %	MgO %	MnO %	Na_2O %	P_2O_5 %	SiO_2 %	TiO_2 %	LOI %	Total	Ba ppm
	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	%	XRF
CH92YK 187 4	14.20	3.82	<0.01	3.46	1.22	1.44	0.10	3.58	0.12	67.8	0.71	2.31	98.8	543
CH92YK 187 5	12.40	2.89	<0.01	1.18	1.17	0.53	0.07	3.63	0.09	76.7	0.38	1.08	100.1	623
CH92YK 187 6	7.03	1.59	<0.01	0.06	0.61	0.08	0.04	2.25	0.05	87.7	<0.01	0.77	100.2	341
HA92YK 304 1	7.29	6.92	1.20	39.50	0.11	2.77	0.38	0.99	0.12	24.1	10.30	<0.46	93.2	<100
HA92YK 304 2	16.80	4.11	0.32	28.80	0.05	3.50	3.11	0.23	0.10	34.5	5.88	0.15	97.5	<100
HA92YK 304 3	16.70	15.00	0.17	10.60	0.20	4.52	0.23	1.16	0.10	43.5	1.66	1.23	95.1	<100
HA92YK 304 4	16.90	9.92	<0.01	3.49	0.74	1.33	0.11	2.68	0.12	54.8	4.13	2.15	96.4	206
HA92YK 304 5	13.90	6.98	<0.01	0.97	0.89	0.48	0.07	3.03	0.17	61.0	8.05	1.23	96.8	278
HA92YK 304 6	6.72	1.92	<0.01	0.08	0.46	0.14	0.19	2.37	0.13	81.5	0.07	0.77	94.3	311
HA92YK 312 1	9.04	8.63	0.68	30.40	0.15	3.55	0.36	1.29	0.14	30.9	8.82	0.92	94.9	<100
HA92YK 312 2	15.00	5.82	0.27	26.20	0.09	4.14	2.38	0.44	0.11	34.5	6.85	0.77	96.6	<100
HA92YK 312 3	16.40	14.90	0.08	10.60	0.20	5.00	0.23	1.22	0.11	44.8	1.58	2.31	97.4	<100
HA92YK 312 4	17.70	10.60	<0.01	3.83	0.70	1.42	0.12	2.68	0.13	54.9	3.71	2.31	98.1	189
HA92YK 312 5	14.80	7.81	<0.01	1.01	0.88	0.44	0.08	3.17	0.22	60.6	6.33	1.38	96.7	279
HA92YK 312 6	7.89	2.50	<0.01	0.27	0.49	0.11	0.15	2.56	0.18	81.0	0.16	0.92	96.2	321
PA92YA 705.1 1	4.01	5.81	0.24	42.20	0.11	2.70	0.66	0.43	0.16	18.0	18.70	<1.08	91.9	<100
PA92YA 705.1 2	13.20	5.69	0.04	29.40	0.08	4.21	1.98	0.26	0.12	32.5	10.80	<0.31	98.0	<100
PA92YA 705.1 3	15.00	17.30	0.04	11.50	0.19	6.36	0.28	0.67	0.10	41.8	2.23	1.08	96.6	<100
PA92YA 705.1 4	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
PA92YA 705.1 5	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
PA92YA 705.1 6	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
PA92YA 705.2 1	5.13	7.06	0.60	35.60	0.16	4.41	0.62	0.67	0.17	22.9	15.80	0.31	93.4	<100
PA92YA 705.2 2	12.90	6.46	0.04	26.90	0.12	4.66	1.73	0.48	0.12	33.9	9.81	<0.15	97.0	<100
PA92YA 705.2 3	16.50	15.60	0.03	10.30	0.32	5.45	0.24	1.19	0.12	44.3	1.61	2.00	97.7	<100
PA92YA 705.2 4	17.10	9.53	<0.01	3.45	1.00	1.86	0.10	2.90	0.13	55.9	2.36	2.00	96.3	365
PA92YA 705.2 5	16.90	7.44	<0.01	2.31	0.99	1.68	0.16	4.48	0.12	62.6	4.23	<0.77	100.1	NSS
PA92YA 705.2 6	9.93	2.92	<0.01	0.29	0.82	0.14	0.08	2.94	0.18	79.8	0.14	0.31	97.6	374
PA92YA 705.5 1	7.16	8.15	0.43	32.00	0.28	5.54	0.50	1.08	0.18	31.4	11.30	<0.01	98.0	<100
PA92YA 705.5 2	13.00	6.83	0.04	25.50	0.20	4.78	1.59	0.63	0.12	36.0	9.24	<0.15	97.8	<100
PA92YA 705.5 3	16.20	12.70	0.03	9.82	0.60	5.28	0.22	1.65	0.13	46.9	1.46	1.54	96.5	129
PA92YA 705.5 4	16.10	6.51	<0.01	3.44	1.32	1.68	0.10	3.41	0.14	61.9	1.12	2.15	97.9	529
PA92YA 705.5 5	14.40	6.69	<0.01	0.97	1.15	0.62	0.07	3.84	0.10	66.9	1.10	4.00	99.8	564
PA92YA 705.5 6	10.10	4.98	<0.01	0.06	1.04	0.24	0.05	3.01	0.08	77.4	0.01	2.46	99.4	463

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Al_2O_3 %	CaO %	Cr_2O_3 %	Fe_2O_3 %	K_2O %	MgO %	MnO %	Na_2O %	P_2O_5 %	SiO_2 %	TiO_2 %	LOI %	Total	Ba ppm
	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	%	XRF
PA92YA 706 1	8.13	11.40	0.10	24.10	0.24	5.71	0.51	0.92	0.19	33.9	10.80	<0.01	96.0	<100
PA92YA 706 2	11.90	8.10	0.03	24.00	0.17	5.94	1.45	0.53	0.12	36.8	8.28	<0.46	96.9	<100
PA92YA 706 3	15.60	17.40	0.03	11.60	0.22	6.65	0.26	0.97	0.12	44.6	1.85	0.77	100.1	<100
PA92YA 706 4	16.50	17.40	0.02	3.29	0.71	2.75	0.12	1.72	0.15	45.9	5.46	2.15	96.2	<100
PA92YA 706 5	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
PA92YA 706 6	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
PA92YA 707.2 1	6.84	6.94	0.20	37.40	0.24	3.53	0.54	1.05	0.18	26.5	13.40	<0.31	96.5	<100
PA92YA 707.2 2	12.20	6.88	0.03	27.60	0.19	5.03	1.50	0.58	0.13	34.8	9.43	<0.01	98.4	<100
PA92YA 707.2 3	15.10	13.70	0.03	10.40	0.50	6.15	0.24	1.64	0.14	46.8	1.66	1.69	98.1	<100
PA92YA 707.2 4	16.50	9.96	<0.01	3.58	1.35	2.26	0.11	3.04	0.16	55.4	1.73	2.62	96.7	443
PA92YA 707.2 5	13.40	15.30	<0.01	0.80	1.14	0.94	0.08	3.20	0.14	50.7	1.79	8.46	96.0	404
PA92YA 707.2 6	10.70	11.90	<0.01	0.06	0.83	0.37	0.06	3.09	0.16	63.1	0.01	6.00	96.3	301
PA92YA 708.2 1	6.49	7.59	0.18	36.00	0.22	3.98	0.55	0.85	0.18	26.4	13.30	<0.31	95.4	<100
PA92YA 708.2 2	11.80	6.71	0.03	27.30	0.18	4.98	1.50	0.48	0.13	33.9	9.19	0.15	96.3	<100
PA92YA 708.2 3	14.80	14.60	0.03	11.10	0.42	6.49	0.25	1.37	0.13	44.9	1.72	1.08	96.9	<100
PA92YA 708.2 4	16.50	11.60	<0.01	3.36	1.20	2.29	0.11	2.72	0.16	53.0	2.48	3.38	96.8	376
PA92YA 708.2 5	13.30	16.30	<0.01	0.81	1.05	0.97	0.08	2.94	0.17	48.3	2.91	7.23	94.1	313
PA92YA 708.2 6	10.30	13.70	<0.01	0.03	0.78	0.51	0.06	2.91	0.24	59.4	0.01	7.54	95.5	328
PA92YA 715.1 1	3.83	4.33	0.91	53.60	0.12	3.37	0.46	0.57	0.14	16.3	10.60	<1.38	92.8	<100
PA92YA 715.1 2	12.50	6.79	0.07	26.00	0.15	4.95	1.54	0.61	0.12	34.3	10.80	<0.46	97.4	<100
PA92YA 715.1 3	17.20	15.30	0.03	10.30	0.34	5.41	0.23	1.33	0.12	45.3	1.46	1.69	98.7	<100
PA92YA 715.1 4	17.70	9.18	<0.01	3.28	1.01	1.70	0.10	3.10	0.14	56.7	2.09	1.85	96.8	345
PA92YA 715.1 5	15.50	6.42	<0.01	1.03	1.00	0.53	0.07	3.76	0.19	64.3	3.05	1.38	97.2	387
PA92YA 715.1 6	9.51	2.89	<0.01	0.07	0.70	0.19	0.09	3.34	0.24	81.0	0.05	0.31	98.4	1053
HA92YA 801.1 1	1.63	1.66	0.26	72.90	0.04	0.90	0.40	0.32	0.12	5.2	9.58	<1.69	91.4	<100
HA92YA 801.1 2	10.40	4.26	0.05	34.40	0.08	3.07	1.72	0.30	0.13	25.5	16.20	<0.92	95.2	<100
HA92YA 801.1 3	14.60	16.30	0.04	11.60	0.24	6.40	0.28	0.85	0.11	41.9	2.04	1.23	95.6	<100
HA92YA 801.1 4	17.60	18.90	<0.01	3.17	0.55	3.74	0.19	2.80	0.13	42.6	7.44	0.77	97.9	NSS
HA92YA 801.1 5	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
HA92YA 801.1 6	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
HA92YA 806.2 1	2.24	2.78	0.25	65.90	0.06	1.35	0.44	0.31	0.13	8.4	10.90	<1.85	90.9	<100
HA92YA 806.2 2	10.90	4.70	0.04	31.90	0.08	3.38	1.78	0.25	0.12	27.3	15.00	<0.46	95.0	<100
HA92YA 806.2 3	14.60	16.80	0.04	12.00	0.21	6.70	0.31	0.74	0.10	41.7	2.17	1.08	96.4	<100

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Al_2O_3 %	CaO %	Cr_2O_3 %	Fe_2O_3 %	K_2O %	MgO %	MnO %	Na_2O %	P_2O_5 %	SiO_2 %	TiO_2 %	LOI %	Total	Ba ppm
	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	%	XRF
HA92YA 806.2 4	14.50	19.30	0.03	3.26	0.56	2.84	0.13	1.30	0.16	42.6	8.70	2.00	95.4	<100
HA92YA 806.2 5	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
HA92YA 806.2 6	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
HA92YA 809.2 1	2.56	3.06	0.22	65.70	0.06	1.60	0.44	0.36	0.14	9.7	10.90	<2.00	92.8	<100
HA92YA 809.2 2	11.10	5.77	0.05	31.10	0.12	4.37	1.65	0.35	0.13	30.6	13.20	<1.38	97.1	<100
HA92YA 809.2 3	14.80	16.50	0.04	11.30	0.27	6.61	0.27	0.95	0.11	43.1	1.86	1.69	97.5	<100
HA92YA 809.2 4	15.90	17.50	0.02	3.35	0.72	2.64	0.13	1.72	0.16	45.8	6.50	2.00	96.4	<100
HA92YA 809.2 5	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
HA92YA 809.2 6	9.97	15.40	<0.01	0.53	0.48	1.90	0.35	3.96	0.77	50.9	0.97	9.23	94.5	NSS
HA92YA 827.2 1	1.10	1.16	0.27	74.10	0.02	0.68	0.41	0.26	0.12	3.2	10.30	<2.31	89.3	<100
HA92YA 827.2 2	10.20	3.75	0.05	36.30	0.06	2.73	1.80	0.18	0.13	23.9	17.70	<0.92	95.9	<100
HA92YA 827.2 3	14.90	17.00	0.05	11.80	0.21	6.34	0.30	0.82	0.11	41.8	2.17	0.62	96.1	<100
HA92YA 827.2 4	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
HA92YA 827.2 5	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
HA92YA 827.2 6	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
HA92YA 840.1 1	2.41	2.94	0.26	67.40	0.05	1.46	0.44	0.27	0.14	9.1	11.00	<1.69	93.8	<100
HA92YA 840.1 2	11.40	6.07	0.04	31.90	0.11	4.49	1.63	0.31	0.13	31.3	12.90	<0.31	100.0	<100
HA92YA 840.1 3	16.10	18.40	0.04	11.10	0.17	6.55	0.27	0.71	0.12	43.6	2.06	1.38	100.5	<100
HA92YA 840.1 4	15.40	19.00	0.02	3.31	0.57	2.66	0.13	1.44	0.15	43.5	8.15	1.85	96.2	<100
HA92YA 840.1 5	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
HA92YA 840.1 6	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
CH92YA 850.4 1	1.59	1.72	0.30	73.70	0.03	0.94	0.42	0.25	0.13	5.2	10.50	<2.15	92.7	<100
CH92YA 850.4 2	11.50	4.74	0.05	34.90	0.07	3.40	1.75	0.23	0.13	28.0	14.70	<1.54	97.9	<100
CH92YA 850.4 3	15.80	17.70	0.04	11.40	0.19	6.57	0.29	0.83	0.12	43.5	2.23	1.85	100.5	<100
CH92YA 850.4 4	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
CH92YA 850.4 5	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
CH92YA 850.4 6	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
CH92YA 865.1 1	2.42	3.47	0.12	57.30	0.01	2.97	0.52	1.62	0.16	9.0	10.20	<1.53	86.3	NSS
CH92YA 865.1 2	10.20	6.09	0.04	31.60	0.14	4.69	1.48	0.37	0.14	30.4	14.40	<0.62	98.9	<100
CH92YA 865.1 3	14.50	15.80	0.04	11.30	0.30	6.85	0.26	1.09	0.12	43.8	1.81	1.69	97.6	<100
CH92YA 865.1 4	16.10	16.10	<0.01	3.09	0.85	2.38	0.12	1.98	0.17	47.5	6.05	2.62	97.0	<100
CH92YA 865.1 5	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
CH92YA 865.1 6	10.30	16.10	<0.01	<0.01	0.40	1.91	0.28	3.88	0.82	54.7	0.13	10.80	99.3	NSS

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Al_2O_3 %	CaO %	Cr_2O_3 %	Fe_2O_3 %	K_2O %	MgO %	MnO %	Na_2O %	P_2O_5 %	SiO_2 %	TiO_2 %	LOI %	Total	Ba ppm
	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	%	XRF
CH92YA 865.2 1	1.31	1.35	0.27	76.90	0.03	0.78	0.38	0.33	0.12	4.1	9.23	<2.62	92.2	<100
CH92YA 865.2 2	9.56	5.50	0.05	35.70	0.08	3.03	1.59	0.23	0.14	24.1	15.50	<1.08	94.4	<100
CH92YA 865.2 3	15.30	16.80	0.04	12.10	0.27	6.64	0.28	0.96	0.12	44.3	2.02	1.08	99.9	<100
CH92YA 865.2 4	17.40	17.00	<0.01	3.84	0.73	3.36	0.19	3.27	0.15	47.5	7.47	0.77	101.7	NSS
CH92YA 865.2 5	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
CH92YA 865.2 6	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
CH92YA 865.4 1	7.69	8.73	0.11	34.10	0.26	4.64	0.41	1.05	0.17	30.5	7.77	0.77	96.2	<100
CH92YA 865.4 2	10.60	9.65	0.03	22.40	0.27	7.65	0.96	0.84	0.13	40.0	7.14	<0.15	99.5	<100
CH92YA 865.4 3	15.30	15.40	0.03	10.80	0.38	6.49	0.24	1.27	0.13	45.7	1.64	0.77	98.1	<100
CH92YA 865.4 4	16.60	12.20	<0.01	3.52	1.22	2.24	0.11	2.60	0.16	52.7	2.71	3.08	97.1	321
CH92YA 865.4 5	15.40	17.50	<0.01	1.59	1.02	2.15	0.16	4.08	0.19	49.8	2.95	5.39	100.2	NSS
CH92YA 865.4 6	10.70	14.40	<0.01	0.07	0.71	0.46	0.06	2.92	0.33	61.0	0.02	7.54	98.2	277
CH92YA 866 1	0.79	0.60	0.34	86.60	0.01	0.46	0.30	0.25	0.11	1.6	6.30	<1.85	95.5	<100
CH92YA 866 2	6.51	2.46	0.07	48.70	0.04	1.65	1.23	0.22	0.18	15.0	19.80	<2.00	93.9	<100
CH92YA 866 3	15.00	16.10	0.05	11.70	0.25	5.98	0.29	0.87	0.12	41.5	2.22	1.69	95.8	<100
CH92YA 866 4	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
CH92YA 866 5	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
CH92YA 866 6	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
HA92YA 833.1 1	5.74	6.56	0.15	45.80	0.19	3.51	0.41	0.79	0.16	23.0	8.57	<0.92	94.0	<100
HA92YA 833.1 2	10.80	8.54	0.03	24.80	0.23	6.57	1.20	0.63	0.13	37.3	9.37	<0.15	99.4	<100
HA92YA 833.1 3	15.00	15.30	0.04	11.10	0.37	6.53	0.25	1.31	0.12	44.9	1.66	1.23	97.8	<100
HA92YA 833.1 4	16.60	13.20	<0.01	3.59	1.09	2.53	0.12	2.36	0.16	51.0	2.97	3.38	97.0	236
HA92YA 833.1 5	15.70	18.10	<0.01	0.80	0.84	2.16	0.14	3.94	0.19	48.8	4.13	6.16	101.0	NSS
HA92YA 833.1 6	10.50	15.20	<0.01	0.02	0.63	0.60	0.07	2.79	0.42	58.4	0.02	9.38	98.0	236
HA92YA 883.2 1	9.37	10.50	0.08	25.20	0.37	5.86	0.36	1.35	0.19	37.5	5.38	<0.31	95.9	<100
HA92YA 883.2 2	9.97	9.84	0.03	19.90	0.32	7.60	0.82	0.88	0.14	39.5	6.61	0.77	96.4	<100
HA92YA 883.2 3	14.60	14.30	0.03	11.40	0.48	6.83	0.26	1.48	0.13	46.2	1.67	0.62	98.0	<100
HA92YA 883.2 4	17.60	12.50	<0.01	3.30	1.13	2.34	0.11	2.64	0.16	54.8	1.92	2.62	99.1	351
HA92YA 883.2 5	14.10	17.20	<0.01	0.70	1.01	1.06	0.08	2.92	0.18	48.4	1.60	9.85	97.1	266
HA92YA 883.2 6	10.40	14.70	<0.01	0.03	0.74	0.52	0.05	2.95	0.22	59.6	<0.01	8.31	97.5	240
HA92YA 890.1 1	8.55	10.10	0.10	29.70	0.29	5.69	0.39	1.18	0.18	34.8	6.31	<0.01	97.3	<100
HA92YA 890.1 2	10.50	10.00	0.03	21.70	0.30	7.73	0.94	0.77	0.14	40.2	7.43	0.46	100.2	<100
HA92YA 890.1 3	14.90	15.40	0.04	11.90	0.41	7.20	0.26	1.30	0.13	46.4	1.75	0.31	100.0	<100

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Al_2O_3 %	CaO %	Cr_2O_3 %	Fe_2O_3 %	K_2O %	MgO %	MnO %	Na_2O %	P_2O_5 %	SiO_2 %	TiO_2 %	LOI %	Total	Ba ppm
	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	%	XRF
HA92YA 890.1 4	18.30	14.70	<0.01	3.29	0.97	2.58	0.12	2.37	0.17	52.4	2.55	2.62	100.1	281
HA92YA 890.1 5	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
HA92YA 890.1 6	10.60	18.00	<0.01	<0.01	0.60	0.77	0.05	2.83	0.38	53.6	0.03	10.00	96.9	211

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Rb ppm	Sr ppm	Nb ppm	Zr ppm	Y ppm	Ce ppm	Eu ppm	La ppm	Lu ppm	Nd ppm	Sm ppm	Tb ppm	Th ppm	U ppm
	XRF	XRF	XRF	XRF	XRF	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA
PA92YK 004.1 1	27	117	26	523	36	66	3.0	17	0.6	10	6.2	0.7	2	<1
PA92YK 004.1 2	<20	47	24	392	306	4	0.5	25	10.8	5	5.9	7.6	6	<1
PA92YK 004.1 3	<20	502	<20	231	72	386	2.5	187	0.8	60	19.8	2.3	45	2
PA92YK 004.1 4	37	488	43	612	42	64	2.5	29	0.6	20	8.4	1.8	12	3
PA92YK 004.1 5	36	408	50	2440	39	34	1.5	16	0.9	10	5.6	0.6	61	16
PA92YK 004.1 6	<20	183	<20	>10000	252	<2	0.5	5	4.6	25	1.1	0.4	11	32
CH92YK 010 1	<20	205	30	358	49	56	2.5	16	0.6	15	7.1	0.4	1	<1
CH92YK 010 2	20	42	31	258	364	50	<0.5	16	12.8	5	4.9	7.7	5	<1
CH92YK 010 3	24	465	<20	146	51	132	2.5	51	0.7	20	9.0	2.2	9	1
CH92YK 010 4	37	452	22	195	41	42	0.5	19	0.3	<5	4.4	0.7	4	1
CH92YK 010 5	55	381	21	312	31	24	0.5	12	0.2	10	2.8	<0.1	4	2
CH92YK 010 6	36	233	<20	2810	35	6	<0.5	3	0.5	<5	0.7	0.2	2	3
PA92YK 027.1 1	27	154	37	247	38	48	2.0	23	0.7	20	8.1	1.3	2	1
PA92YK 027.1 2	20	127	55	328	171	100	2.0	27	5.4	20	7.1	3.2	4	1
PA92YK 027.1 3	26	397	24	139	76	278	2.5	134	1.7	80	17.0	2.0	28	3
PA92YK 027.1 4	41	511	57	395	59	110	4.0	49	0.9	55	15.9	1.8	18	8
PA92YK 027.1 5	68	561	50	961	45	28	1.5	12	0.7	15	5.9	0.7	21	7
PA92YK 027.1 6	33	361	<20	>10000	124	4	<0.5	3	2.0	10	1.2	0.4	5	15
PA92YK 028.4 1	22	189	<20	192	54	42	2.5	19	0.7	25	7.9	1.6	1	<1
PA92YK 028.4 2	21	144	27	212	134	94	1.5	31	4.5	25	7.7	4.5	4	1
PA92YK 028.4 3	<20	411	26	129	57	148	2.5	83	0.8	30	11.3	1.4	15	2
PA92YK 028.4 4	37	467	28	175	38	68	2.0	32	0.4	20	7.5	2.3	6	3
PA92YK 028.4 5	28	442	27	382	<20	48	1.5	18	0.4	10	5.3	1.6	10	4
PA92YK 028.4 6	26	260	<20	2490	<20	8	0.5	3	0.4	5	0.8	0.3	1	4
HA92YK 106 1	<20	72	48	638	<20	64	1.5	16	0.6	10	4.3	0.5	1	2
HA92YK 106 2	22	42	20	487	344	70	1.0	41	12.6	15	6.6	9.2	10	1
HA92YK 106 3	22	556	<20	435	50	552	3.5	337	0.9	90	27.4	2.1	72	3
HA92YK 106 4	41	538	38	1940	68	82	2.0	37	1.0	25	9.4	1.0	31	13
HA92YK 106 5	37	386	81	8730	138	28	2.5	27	2.8	15	8.4	1.5	178	53
HA92YK 106 6	38	83	<20	>10000	998	<2	1.0	9	19.0	315	0.2	4.2	59	164
HA92YK 107 1	20	69	37	466	<20	46	2.0	20	0.6	25	4.8	1.5	2	<1
HA92YK 107 2	27	31	40	415	327	74	1.5	29	12.6	15	5.0	6.5	6	1
HA92YK 107 3	20	560	25	322	60	800	4.5	362	1.0	170	27.7	2.5	76	4

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Rb ppm	Sr ppm	Nb ppm	Zr ppm	Y ppm	Ce ppm	Eu ppm	La ppm	Lu ppm	Nd ppm	Sm ppm	Tb ppm	Th ppm	U ppm
	XRF	XRF	XRF	XRF	XRF	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA
HA92YK 107 4	22	527	54	1640	62	122	4.0	42	1.1	65	10.8	1.6	25	10
HA92YK 107 5	37	403	105	7630	124	58	3.5	30	2.6	60	5.8	2.0	141	38
HA92YK 107 6	36	117	<20	>10000	844	16	0.5	8	15.6	20	0.4	1.2	45	98
HA92YK 108 1	<20	200	36	282	37	42	2.5	19	0.7	35	6.8	1.0	1	<1
HA92YK 108 2	21	122	43	252	220	80	2.0	27	7.3	30	6.1	3.7	4	1
HA92YK 108 3	33	454	<20	109	42	204	3.0	96	0.7	80	11.1	1.9	18	1
HA92YK 108 4	27	509	22	315	28	74	2.0	22	0.5	35	5.9	0.5	8	2
HA92YK 108 5	53	457	36	636	35	40	1.5	14	0.5	10	4.5	0.3	9	4
HA92YK 108 6	27	255	<20	4560	44	8	0.5	3	0.6	10	0.6	0.3	2	4
HA92YK 109 1	22	97	31	490	26	60	2.5	21	0.7	15	6.4	0.5	1	1
HA92YK 109 2	27	36	55	426	296	56	0.5	27	12.1	25	6.1	7.9	5	1
HA92YK 109 3	26	555	<20	309	54	570	3.5	292	1.0	105	24.9	1.8	69	2
HA92YK 109 4	<20	561	36	1560	76	102	3.5	44	1.2	30	13.1	1.3	29	11
HA92YK 109 5	42	420	112	7700	140	54	3.5	35	3.0	25	11.3	1.4	103	33
HA92YK 109 6	185	104	<20	>10000	925	<2	1.0	10	21.4	30	1.2	3.3	66	128
HA92YK 125 1	32	228	32	218	39	58	2.5	18	0.6	15	7.5	0.9	1	1
HA92YK 125 2	23	178	29	150	206	52	2.0	19	6.0	10	6.2	3.1	3	1
HA92YK 125 3	25	400	21	122	39	86	2.0	37	0.7	15	7.2	2.2	5	<1
HA92YK 125 4	48	448	<20	193	25	52	1.5	20	0.3	5	4.5	2.2	5	<1
HA92YK 125 5	53	383	<20	113	<20	34	1.0	14	0.2	<5	2.8	0.4	3	1
HA92YK 125 6	33	216	<20	285	<20	8	0.5	3	<0.1	<5	0.6	0.2	<1	<1
CH92YK 128 1	33	209	27	177	35	46	3.0	16	0.5	5	6.9	0.9	1	<1
CH92YK 128 2	<20	126	35	193	266	34	1.5	21	7.6	<5	5.7	6.7	3	<1
CH92YK 128 3	20	455	<20	108	39	112	2.5	47	0.5	20	8.3	1.2	7	<1
CH92YK 128 4	NSS	NSS	NSS	NSS	NSS	48	1.0	21	0.3	10	4.6	0.6	4	2
CH92YK 128 5	44	467	31	148	<20	26	0.5	11	0.2	<5	2.3	0.3	5	2
CH92YK 128 6	43	419	17	182	20	6	<0.5	2	0.1	<5	0.5	0.1	1	<1
CH92YK 137.2 1	45	212	<20	1240	<20	58	2.0	17	0.5	20	5.4	2.5	1	1
CH92YK 137.2 2	22	165	28	232	22	40	1.5	20	11.5	10	4.8	6.1	4	1
CH92YK 137.2 3	26	71	25	182	341	136	2.5	59	0.8	25	8.2	1.6	12	1
CH92YK 137.2 4	<20	418	20	84	32	38	1.5	19	0.3	15	3.9	0.9	4	1
CH92YK 137.2 5	54	441	40	151	<20	24	1.0	12	0.2	5	2.1	0.7	5	3
CH92YK 137.2 6	53	382	<20	275	<20	6	<0.5	3	0.3	<5	0.3	0.6	1	2

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Rb ppm	Sr ppm	Nb ppm	Zr ppm	Y ppm	Ce ppm	Eu ppm	La ppm	Lu ppm	Nd ppm	Sm ppm	Tb ppm	Th ppm	U ppm
	XRF	XRF	XRF	XRF	XRF	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA
HA92YK 144 1	29	200	23	1960	<20	52	2.5	17	0.6	20	6.2	1.2	1	1
HA92YK 144 2	25	202	<20	195	46	48	1.0	19	5.1	15	5.0	3.7	3	<1
HA92YK 144 3	31	156	40	178	176	78	2.0	38	0.9	30	6.4	0.8	7	1
HA92YK 144 4	33	364	<20	101	43	42	1.0	20	0.3	15	4.0	1.1	4	2
HA92YK 144 5	50	432	<20	115	27	24	0.5	10	0.2	10	2.4	0.4	3	1
HA92YK 144 6	50	403	<20	151	<20	6	<0.5	3	0.1	<5	0.6	0.2	1	1
CH92YK 162 1	<20	226	<20	585	<20	72	2.5	20	0.7	20	7.0	4.5	1	1
CH92YK 162 2	22	158	36	295	31	90	1.0	40	7.3	5	6.5	5.4	6	<1
CH92YK 162 3	<20	80	30	272	202	258	3.5	133	0.8	60	13.1	3.2	24	2
CH92YK 162 4	31	414	<20	119	61	80	2.0	30	0.6	20	8.2	0.8	12	4
CH92YK 162 5	39	493	48	360	29	48	2.0	21	0.7	15	6.2	1.1	11	6
CH92YK 162 6	38	642	34	1220	50	<2	<0.5	3	1.7	20	0.8	0.2	5	10
CH92YK 168.1 1	33	238	<20	>10000	102	76	2.0	21	1.0	15	5.8	0.9	4	2
CH92YK 168.1 2	NSS	NSS	NSS	NSS	NSS	96	1.0	52	8.3	20	7.4	4.3	8	2
CH92YK 168.1 3	26	53	30	390	222	322	4.5	230	0.8	80	21.4	1.8	49	2
CH92YK 168.1 4	<20	429	27	199	57	102	5.0	44	1.1	35	15.1	1.6	23	10
CH92YK 168.1 5	39	433	86	3180	117	54	4.0	33	1.9	25	10.5	2.0	94	31
CH92YK 168.1 6	31	151	<20	>10000	378	<2	0.5	7	6.1	135	0.8	0.5	16	49
CH92YK 172 1	36	155	30	351	24	46	2.0	21	0.7	30	7.4	1.0	2	1
CH92YK 172 2	<20	102	31	314	169	66	1.5	38	6.2	15	7.2	3.1	6	1
CH92YK 172 3	30	361	33	124	59	156	3.0	97	1.2	30	12.1	1.6	20	2
CH92YK 172 4	54	455	81	217	21	62	2.0	29	0.5	20	6.8	1.0	8	3
CH92YK 172 5	40	428	29	455	24	34	1.0	17	0.4	10	4.1	0.4	17	5
CH92YK 172 6	<20	230	<20	3430	46	6	<0.5	3	0.7	10	0.5	0.2	3	5
HA92YK 181 1	37	167	33	<10	31	42	3.0	18	0.7	15	8.5	1.3	1	1
HA92YK 181 2	24	140	41	178	153	48	1.5	21	5.1	5	7.2	6.2	4	<1
HA92YK 181 3	34	435	<20	95	56	230	3.5	91	0.8	45	13.3	3.1	22	1
HA92YK 181 4	222	548	35	187	<10	124	2.5	39	0.8	35	12.9	1.0	12	5
HA92YK 181 5	44	508	51	816	39	80	3.0	28	0.9	25	10.6	1.1	29	10
HA92YK 181 6	34	298	22	7520	83	10	<0.5	5	1.2	35	1.4	0.6	5	8
CH92YK 187 1	NSS	NSS	NSS	NSS	NSS	50	2.5	14	0.6	15	6.9	1.6	1	<1
CH92YK 187 2	35	162	39	158	154	38	1.5	18	5.0	<5	5.8	4.4	3	1
CH92YK 187 3	28	338	<20	101	26	78	1.5	28	0.6	15	6.8	2.5	6	<1

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Rb ppm	Sr ppm	Nb ppm	Zr ppm	Y ppm	Ce ppm	Eu ppm	La ppm	Lu ppm	Nd ppm	Sm ppm	Tb ppm	Th ppm	U ppm
	XRF	XRF	XRF	XRF	XRF	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA
CH92YK 187 4	49	407	<20	141	23	54	0.5	17	0.3	10	4.6	0.7	5	1
CH92YK 187 5	59	392	21	127	<10	20	0.5	8	0.2	10	2.2	<0.1	3	<1
CH92YK 187 6	33	251	24	369	<20	6	<0.5	3	0.1	<5	0.5	<0.1	<1	<1
HA92YK 304 1	28	90	36	360	<20	34	1.5	17	0.5	15	4.7	0.6	1	<1
HA92YK 304 2	<20	41	31	376	282	44	1.5	22	10.7	15	4.8	4.6	5	1
HA92YK 304 3	<20	473	<20	196	66	428	3.5	233	1.1	145	22.5	3.7	60	3
HA92YK 304 4	33	490	44	847	68	88	3.0	41	1.0	55	11.6	1.7	22	9
HA92YK 304 5	52	401	83	3510	91	48	2.5	23	1.7	35	8.4	1.6	91	26
HA92YK 304 6	40	174	<20	>10000	395	<2	<0.5	5	6.5	30	<0.1	0.4	18	38
HA92YK 312 1	26	121	<20	341	28	46	2.5	23	0.7	25	6.4	0.7	1	<1
HA92YK 312 2	<20	83	55	280	<20	66	1.5	31	8.0	20	6.0	4.5	4	<1
HA92YK 312 3	23	460	29	321	51	280	3.5	159	0.8	65	18.5	1.6	24	2
HA92YK 312 4	40	522	52	484	43	84	1.5	42	0.7	30	14.5	1.1	13	4
HA92YK 312 5	36	454	72	2060	81	56	1.0	30	1.0	25	12.0	0.8	28	10
HA92YK 312 6	25	247	<20	>10000	196	16	<0.5	5	3.4	<5	1.2	0.4	7	17
PA92YA 705.1 1	<20	87	52	220	29	206	3.0	101	0.9	40	11.6	4.8	14	2
PA92YA 705.1 2	24	41	46	141	171	126	2.0	54	6.2	15	7.7	4.2	9	1
PA92YA 705.1 3	<20	513	35	117	72	1204	6.0	722	0.9	175	54.4	3.1	177	4
PA92YA 705.1 4	NSS	NSS	NSS	NSS	NSS	734	26.5	266	6.3	295	83.7	11.2	74	35
PA92YA 705.1 5	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
PA92YA 705.1 6	NSS	NSS	NSS	NSS	NSS	16	1.0	7	4.5	45	2.1	0.5	13	21
PA92YA 705.2 1	21	127	78	187	<20	170	3.0	85	0.8	25	9.9	1.2	14	1
PA92YA 705.2 2	<20	63	56	143	146	122	2.5	56	5.5	20	7.9	3.0	10	1
PA92YA 705.2 3	21	534	<20	94	69	544	4.0	313	0.8	95	25.1	2.2	87	3
PA92YA 705.2 4	37	541	50	178	70	126	4.5	51	1.1	35	13.7	1.0	16	6
PA92YA 705.2 5	NSS	NSS	NSS	NSS	NSS	78	3.5	37	1.4	25	10.0	1.9	18	8
PA92YA 705.2 6	27	412	<20	5527	59	6	1.5	4	0.4	20	0.5	1.6	4	4
PA92YA 705.5 1	<20	161	50	170	25	138	2.5	51	0.9	35	7.9	1.3	6	1
PA92YA 705.5 2	<20	98	43	149	155	102	1.5	47	4.9	20	7.4	3.3	8	1
PA92YA 705.5 3	29	485	24	82	63	334	2.5	182	0.7	60	15.2	1.3	47	2
PA92YA 705.5 4	40	515	24	175	43	66	1.5	25	0.5	15	6.1	2.4	6	1
PA92YA 705.5 5	35	591	21	194	<20	28	1.0	14	0.3	10	3.4	1.4	4	2
PA92YA 705.5 6	39	455	49	713	<20	6	0.5	3	0.5	5	0.5	0.9	1	1

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Rb ppm	Sr ppm	Nb ppm	Zr ppm	Y ppm	Ce ppm	Eu ppm	La ppm	Lu ppm	Nd ppm	Sm ppm	Tb ppm	Th ppm	U ppm
	XRF	XRF	XRF	XRF	XRF	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA
PA92YA 706 1	39	227	71	161	42	228	4.0	95	1.2	50	14.0	1.4	13	1
PA92YA 706 2	<20	78	40	126	123	108	2.5	39	4.3	25	7.5	1.8	6	1
PA92YA 706 3	23	535	<20	78	56	462	4.0	266	0.9	95	21.8	3.5	66	2
PA92YA 706 4	40	519	124	194	172	266	11.5	117	2.7	175	35.2	4.8	28	14
PA92YA 706 5	NSS	NSS	NSS	NSS	NSS	236	8.5	101	2.4	145	28.0	4.0	29	17
PA92YA 706 6	NSS	NSS	NSS	NSS	NSS	18	1.0	9	0.6	10	2.3	0.9	2	3
PA92YA 707.2 1	27	138	60	182	<20	152	2.5	70	0.9	50	9.3	1.7	7	2
PA92YA 707.2 2	<20	90	45	175	132	98	2.0	49	5.0	30	7.9	3.2	8	1
PA92YA 707.2 3	33	460	33	149	42	334	3.5	214	0.8	115	18.7	1.7	49	2
PA92YA 707.2 4	57	549	47	167	46	98	3.0	43	0.9	50	10.4	1.2	11	4
PA92YA 707.2 5	50	721	39	379	<20	54	3.0	29	0.7	30	6.4	1.1	8	4
PA92YA 707.2 6	32	598	<20	3090	21	8	0.5	4	0.5	<5	0.6	0.5	2	3
PA92YA 708.2 1	<20	147	51	212	30	128	2.5	57	0.8	45	8.1	1.0	7	1
PA92YA 708.2 2	<20	67	37	174	132	96	2.0	34	4.9	10	7.0	3.6	5	<1
PA92YA 708.2 3	22	474	<20	90	52	366	4.5	207	1.0	85	18.5	4.3	37	1
PA92YA 708.2 4	52	541	57	229	69	146	5.0	56	1.4	50	17.1	2.9	12	5
PA92YA 708.2 5	37	688	48	511	76	114	4.0	44	1.2	35	12.8	1.9	9	7
PA92YA 708.2 6	28	607	<20	4381	54	8	1.0	4	0.8	5	0.9	0.7	2	2
PA92YA 715.1 1	23	57	48	204	<20	92	1.5	33	0.6	15	6.1	1.4	4	1
PA92YA 715.1 2	22	68	51	196	117	100	2.0	33	4.6	10	6.6	3.2	5	1
PA92YA 715.1 3	23	464	27	91	60	250	3.0	135	1.1	60	14.9	2.1	26	2
PA92YA 715.1 4	56	565	43	281	61	100	2.5	41	0.9	25	10.0	0.8	17	4
PA92YA 715.1 5	43	559	36	1344	40	56	2.0	23	1.0	15	6.5	1.4	15	7
PA92YA 715.1 6	43	393	<20	11220	122	6	<0.5	4	1.9	15	1.0	0.3	5	8
HA92YA 801.1 1	<20	<20	42	192	<20	68	1.0	28	0.6	5	3.1	0.4	3	1
HA92YA 801.1 2	<20	42	56	286	138	88	1.5	40	5.9	5	5.7	4.2	6	<1
HA92YA 801.1 3	<20	487	<20	255	76	1194	6.0	528	1.2	285	35.3	3.4	109	4
HA92YA 801.1 4	NSS	NSS	NSS	NSS	NSS	500	15.0	147	3.7	170	41.2	7.2	76	33
HA92YA 801.1 5	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
HA92YA 801.1 6	NSS	NSS	NSS	NSS	NSS	<2	1.0	15	24.5	60	1.7	2.7	68	120
HA92YA 806.2 1	<20	37	32	343	<20	118	1.5	47	0.7	20	5.3	0.7	6	2
HA92YA 806.2 2	<20	41	64	229	140	84	2.0	42	5.3	25	6.4	5.9	7	<1
HA92YA 806.2 3	<20	487	22	136	74	1284	5.0	567	1.4	310	39.4	3.2	132	3

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Rb ppm	Sr ppm	Nb ppm	Zr ppm	Y ppm	Ce ppm	Eu ppm	La ppm	Lu ppm	Nd ppm	Sm ppm	Tb ppm	Th ppm	U ppm
	XRF	XRF	XRF	XRF	XRF	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA
HA92YA 806.2 4	20	447	179	1100	270	722	18.0	186	4.7	240	55.1	9.0	62	26
HA92YA 806.2 5	NSS	NSS	NSS	NSS	NSS	194	6.5	63	2.2	95	17.6	2.9	36	17
HA92YA 806.2 6	NSS	NSS	NSS	NSS	NSS	16	<0.5	13	12.1	25	1.4	4.3	34	57
HA92YA 809.2 1	<20	51	45	331	<20	110	1.0	40	0.6	25	5.0	1.0	5	2
HA92YA 809.2 2	<20	41	59	218	130	112	1.5	45	5.0	35	7.3	3.0	7	1
HA92YA 809.2 3	<20	512	31	145	75	872	6.0	462	1.4	260	36.6	4.9	97	4
HA92YA 809.2 4	49	509	138	947	184	434	12.0	140	2.8	220	38.7	6.0	43	15
HA92YA 809.2 5	NSS	NSS	NSS	NSS	NSS	156	5.5	57	2.0	80	15.3	2.4	31	14
HA92YA 809.2 6	NSS	NSS	NSS	NSS	NSS	24	1.5	16	10.0	25	5.6	1.7	22	46
HA92YA 827.2 1	<20	<20	45	184	<20	52	0.5	24	0.3	15	2.7	0.6	3	<1
HA92YA 827.2 2	33	21	80	306	132	68	5.5	42	6.0	30	6.0	5.8	6	1
HA92YA 827.2 3	NSS	500	<20	435	101	1298	4.0	815	1.5	410	58.9	3.5	204	10
HA92YA 827.2 4	NSS	NSS	NSS	NSS	NSS	362	12.5	147	3.8	240	43.6	6.3	80	39
HA92YA 827.2 5	NSS	NSS	NSS	NSS	NSS	182	6.5	73	5.8	130	21.0	4.1	124	60
HA92YA 827.2 6	<20	NSS	NSS	NSS	NSS	22	0.5	10	24.9	15	2.6	2.4	71	143
HA92YA 840.1 1	<20	40	39	229	<20	74	1.0	38	0.5	30	4.7	0.5	6	2
HA92YA 840.1 2	<20	50	64	200	135	108	1.5	65	4.5	45	9.0	2.7	14	1
HA92YA 840.1 3	95	563	28	204	54	794	5.5	514	1.1	265	38.6	2.1	125	3
HA92YA 840.1 4	NSS	498	166	1356	231	420	14.0	160	3.5	245	47.7	6.5	55	26
HA92YA 840.1 5	NSS	NSS	NSS	NSS	NSS	92	3.0	35	1.2	60	10.4	1.6	23	11
HA92YA 840.1 6	<20	NSS	NSS	NSS	NSS	26	1.0	16	10.2	25	4.8	1.2	32	60
CH92YA 850.4 1	20	21	30	196	<20	66	0.5	31	0.6	10	4.2	0.8	4	<1
CH92YA 850.4 2	<20	29	55	274	134	84	2.0	56	6.5	15	9.1	6.9	9	<1
CH92YA 850.4 3	NSS	534	27	229	91	854	6.0	544	1.5	155	43.2	1.6	125	5
CH92YA 850.4 4	NSS	NSS	NSS	NSS	NSS	384	13.5	168	4.5	135	53.3	6.4	89	29
CH92YA 850.4 5	NSS	NSS	NSS	NSS	NSS	96	2.5	43	2.4	30	14.1	1.3	67	21
CH92YA 850.4 6	NSS	NSS	NSS	NSS	NSS	<2	1.0	14	30.5	90	2.6	2.9	69	148
CH92YA 865.1 1	NSS	NSS	NSS	NSS	NSS	68	1.0	35	0.7	5	5.1	1.6	4	2
CH92YA 865.1 2	<20	47	53	232	111	58	1.5	40	5.3	10	8.0	2.8	7	1
CH92YA 865.1 3	21	492	30	146	59	480	3.5	303	1.2	110	27.3	1.4	68	2
CH92YA 865.1 4	48	519	122	848	191	342	11.5	156	3.7	120	48.3	5.5	69	25
CH92YA 865.1 5	NSS	NSS	NSS	NSS	NSS	172	6.5	69	3.1	100	21.4	3.6	37	22
CH92YA 865.1 6	NSS	NSS	NSS	NSS	NSS	26	0.5	12	10.4	40	2.8	1.5	23	48

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Rb ppm	Sr ppm	Nb ppm	Zr ppm	Y ppm	Ce ppm	Eu ppm	La ppm	Lu ppm	Nd ppm	Sm ppm	Tb ppm	Th ppm	U ppm
	XRF	XRF	XRF	XRF	XRF	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA
CH92YA 865.2 1	<20	<20	24	232	<20	36	0.5	16	0.4	15	3.0	0.8	4	2
CH92YA 865.2 2	22	46	62	280	120	68	1.5	44	5.9	30	7.3	3.8	7	1
CH92YA 865.2 3	21	512	25	281	65	814	4.5	471	1.3	235	38.8	2.7	100	5
CH92YA 865.2 4	NSS	NSS	NSS	NSS	NSS	442	16.0	172	4.8	250	56.1	8.2	70	31
CH92YA 865.2 5	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
CH92YA 865.2 6	NSS	NSS	NSS	NSS	NSS	24	1.5	11	23.4	35	2.3	2.2	37	99
CH92YA 865.4 1	<20	174	53	275	34	100	3.0	53	1.0	45	10.2	1.5	7	1
CH92YA 865.4 2	22	119	37	177	92	88	2.5	45	3.0	45	10.2	2.8	7	1
CH92YA 865.4 3	34	507	30	95	47	256	3.5	135	0.8	85	16.1	2.0	25	2
CH92YA 865.4 4	66	563	82	191	91	180	5.0	67	1.5	50	20.1	2.2	19	7
CH92YA 865.4 5	NSS	NSS	NSS	NSS	NSS	100	4.5	45	1.3	25	12.8	2.3	21	7
CH92YA 865.4 6	39	631	<20	2234	<20	12	<0.5	5	0.7	5	1.3	<0.1	1	3
CH92YA 866 1	<20	<20	30	184	<20	24	<0.5	8	0.3	<5	1.2	1.1	2	<1
CH92YA 866 2	<20	33	61	438	80	70	1.0	34	4.4	10	4.8	1.7	7	2
CH92YA 866 3	33	495	55	828	127	1824	7.0	1037	2.9	255	74.2	12.9	276	22
CH92YA 866 4	NSS	NSS	NSS	NSS	NSS	206	6.5	91	3.2	60	25.1	3.9	243	65
CH92YA 866 5	NSS	NSS	NSS	NSS	NSS	82	3.5	49	4.4	60	12.7	1.7	485	89
CH92YA 866 6	NSS	NSS	NSS	NSS	NSS	30	0.5	11	38.0	10	0.2	6.0	128	190
HA92YA 833.1 1	<20	129	48	557	<20	100	2.5	44	1.0	20	8.2	0.6	7	2
HA92YA 833.1 2	20	83	50	182	108	90	2.5	52	4.2	20	10.3	3.4	11	1
HA92YA 833.1 3	33	488	34	105	38	398	4.0	241	1.0	85	20.3	1.7	63	1
HA92YA 833.1 4	51	534	57	329	80	168	5.5	72	1.5	55	21.0	2.7	23	9
HA92YA 833.1 5	NSS	NSS	NSS	NSS	NSS	162	6.0	74	1.8	55	20.2	2.5	32	14
HA92YA 833.1 6	27	609	20	6512	66	10	<0.5	6	1.4	15	1.6	0.1	5	7
HA92YA 883.2 1	22	226	38	167	48	94	3.0	48	1.0	25	10.2	0.8	7	1
HA92YA 883.2 2	25	131	44	128	72	50	2.5	34	2.9	15	9.8	4.5	6	<1
HA92YA 883.2 3	44	434	36	99	44	144	2.5	84	0.9	30	11.2	2.2	17	<1
HA92YA 883.2 4	51	577	53	175	83	98	2.5	40	0.9	30	12.3	1.1	12	5
HA92YA 883.2 5	44	738	33	192	43	66	2.0	29	0.7	20	8.7	0.6	15	5
HA92YA 883.2 6	27	622	<20	868	20	6	0.5	5	0.3	<5	0.9	0.5	1	2
HA92YA 890.1 1	27	208	21	161	34	62	2.5	44	0.9	25	9.2	0.4	5	<1
HA92YA 890.1 2	<20	118	55	149	55	62	2.0	34	0.6	20	8.9	1.0	5	2
HA92YA 890.1 3	<20	431	27	114	39	144	3.5	104	1.0	35	12.7	0.7	24	1

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Rb ppm	Sr ppm	Nb ppm	Zr ppm	Y ppm	Ce ppm	Eu ppm	La ppm	Lu ppm	Nd ppm	Sm ppm	Tb ppm	Th ppm	U ppm
	XRF	XRF	XRF	XRF	XRF	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA
HA92YA 890.1 4	35	612	46	169	69	110	3.5	62	1.4	40	17.4	2.7	18	8
HA92YA 890.1 5	NSS	NSS	NSS	NSS	NSS	100	3.5	55	1.4	35	15.5	2.3	22	9
HA92YA 890.1 6	38	665	26	2157	23	8	0.5	6	0.6	<5	1.6	0.8	2	3

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Yb ppm	Au oz/t	Pt oz/t	Pd oz/t	Rh oz/t	Sn ppm
	NAA	FA - ICP	FA - ICP	FA - ICP	FA - ICP	AAS
PA92YK 004.1 1	4.3	<0.015	<0.030	<0.030	<0.015	----
PA92YK 004.1 2	72.1	----	----	----	----	----
PA92YK 004.1 3	5.3	----	----	----	----	----
PA92YK 004.1 4	4.0	----	----	----	----	----
PA92YK 004.1 5	5.6	----	----	----	----	<2
PA92YK 004.1 6	22.7	----	----	----	----	----
CH92YK 010 1	4.4	<0.015	<0.030	<0.030	<0.015	----
CH92YK 010 2	84.1	----	----	----	----	----
CH92YK 010 3	4.7	----	----	----	----	----
CH92YK 010 4	2.4	----	----	----	----	----
CH92YK 010 5	1.5	----	----	----	----	<2
CH92YK 010 6	2.5	----	----	----	----	----
PA92YK 027.1 1	4.7	<0.030	<0.060	<0.060	<0.030	----
PA92YK 027.1 2	35.5	----	----	----	----	----
PA92YK 027.1 3	11.8	----	----	----	----	----
PA92YK 027.1 4	6.4	----	----	----	----	----
PA92YK 027.1 5	3.5	----	----	----	----	<2
PA92YK 027.1 6	9.7	----	----	----	----	----
PA92YK 028.4 1	4.5	NSS	NSS	NSS	NSS	----
PA92YK 028.4 2	28.9	----	----	----	----	----
PA92YK 028.4 3	6.0	----	----	----	----	----
PA92YK 028.4 4	3.5	----	----	----	----	----
PA92YK 028.4 5	3.0	----	----	----	----	<2
PA92YK 028.4 6	2.4	----	----	----	----	----
HA92YK 106 1	3.8	0.135	<0.030	<0.030	<0.015	----
HA92YK 106 2	92.3	----	----	----	----	----
HA92YK 106 3	6.9	----	----	----	----	----
HA92YK 106 4	6.7	----	----	----	----	----
HA92YK 106 5	15.7	----	----	----	----	<2
HA92YK 106 6	98.4	----	----	----	----	----
HA92YK 107 1	4.0	<0.015	<0.030	<0.030	<0.015	----
HA92YK 107 2	84.3	----	----	----	----	----
HA92YK 107 3	5.8	----	----	----	----	----

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Yb ppm	Au oz/t	Pt oz/t	Pd oz/t	Rh oz/t	Sn ppm
	NAA	FA - ICP	FA - ICP	FA - ICP	FA - ICP	AAS
HA92YK 107 4	6.3	----	----	----	----	----
HA92YK 107 5	12.8	----	----	----	----	<2
HA92YK 107 6	74.9	----	----	----	----	----
HA92YK 108 1	4.8	NSS	NSS	NSS	NSS	----
HA92YK 108 2	48.2	----	----	----	----	----
HA92YK 108 3	4.7	----	----	----	----	----
HA92YK 108 4	3.2	----	----	----	----	----
HA92YK 108 5	3.1	----	----	----	----	<2
HA92YK 108 6	3.4	----	----	----	----	----
HA92YK 109 1	4.7	<0.015	<0.030	<0.030	<0.015	----
HA92YK 109 2	85.9	----	----	----	----	----
HA92YK 109 3	7.2	----	----	----	----	----
HA92YK 109 4	8.1	----	----	----	----	----
HA92YK 109 5	17.3	----	----	----	----	<2
HA92YK 109 6	104.2	----	----	----	----	----
HA92YK 125 1	4.9	NSS	NSS	NSS	NSS	----
HA92YK 125 2	44.1	----	----	----	----	----
HA92YK 125 3	5.6	----	----	----	----	----
HA92YK 125 4	2.1	----	----	----	----	----
HA92YK 125 5	1.4	----	----	----	----	<2
HA92YK 125 6	0.4	----	----	----	----	----
CH92YK 128 1	4.1	NSS	NSS	NSS	NSS	----
CH92YK 128 2	53.9	----	----	----	----	----
CH92YK 128 3	3.9	----	----	----	----	----
CH92YK 128 4	2.2	----	----	----	----	----
CH92YK 128 5	1.2	----	----	----	----	<2
CH92YK 128 6	1.0	----	----	----	----	----
CH92YK 137.2 1	3.6	NSS	NSS	NSS	NSS	----
CH92YK 137.2 2	72.0	----	----	----	----	----
CH92YK 137.2 3	5.1	----	----	----	----	----
CH92YK 137.2 4	2.2	----	----	----	----	----
CH92YK 137.2 5	1.6	----	----	----	----	8
CH92YK 137.2 6	1.4	----	----	----	----	----

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Yb ppm	Au oz/t	Pt oz/t	Pd oz/t	Rh oz/t	Sn ppm
	NAA	FA - ICP	FA - ICP	FA - ICP	FA - ICP	AAS
HA92YK 144 1	4.1	NSS	NSS	NSS	NSS	----
HA92YK 144 2	31.0	----	----	----	----	----
HA92YK 144 3	5.5	----	----	----	----	----
HA92YK 144 4	2.2	----	----	----	----	----
HA92YK 144 5	1.3	----	----	----	----	<2
HA92YK 144 6	0.6	----	----	----	----	----
CH92YK 162 1	4.0	<0.015	<0.030	<0.030	<0.015	----
CH92YK 162 2	42.8	----	----	----	----	----
CH92YK 162 3	4.2	----	----	----	----	----
CH92YK 162 4	3.8	----	----	----	----	----
CH92YK 162 5	4.1	----	----	----	----	<2
CH92YK 162 6	7.7	----	----	----	----	----
CH92YK 168.1 1	5.0	NSS	NSS	NSS	NSS	----
CH92YK 168.1 2	46.9	----	----	----	----	----
CH92YK 168.1 3	6.0	----	----	----	----	----
CH92YK 168.1 4	8.4	----	----	----	----	----
CH92YK 168.1 5	11.5	----	----	----	----	<2
CH92YK 168.1 6	31.5	----	----	----	----	----
CH92YK 172 1	5.3	NSS	NSS	NSS	NSS	----
CH92YK 172 2	43.3	----	----	----	----	----
CH92YK 172 3	8.6	----	----	----	----	----
CH92YK 172 4	3.8	----	----	----	----	----
CH92YK 172 5	2.3	----	----	----	----	<2
CH92YK 172 6	3.7	----	----	----	----	----
HA92YK 181 1	4.7	<0.030	<0.060	<0.060	<0.030	----
HA92YK 181 2	30.4	----	----	----	----	----
HA92YK 181 3	5.1	----	----	----	----	----
HA92YK 181 4	5.8	----	----	----	----	----
HA92YK 181 5	5.8	----	----	----	----	<2
HA92YK 181 6	5.8	----	----	----	----	----
CH92YK 187 1	4.1	NSS	NSS	NSS	NSS	----
CH92YK 187 2	29.2	----	----	----	----	----
CH92YK 187 3	4.2	----	----	----	----	----

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Yb ppm	Au oz/t	Pt oz/t	Pd oz/t	Rh oz/t	Sn ppm
	NAA	FA - ICP	FA - ICP	FA - ICP	FA - ICP	AAS
CH92YK 187 4	2.1	----	----	----	----	----
CH92YK 187 5	1.5	----	----	----	----	<2
CH92YK 187 6	0.6	----	----	----	----	----
HA92YK 304 1	3.7	<0.015	<0.030	<0.030	<0.015	----
HA92YK 304 2	70.6	----	----	----	----	----
HA92YK 304 3	7.5	----	----	----	----	----
HA92YK 304 4	6.7	----	----	----	----	----
HA92YK 304 5	9.8	----	----	----	----	<2
HA92YK 304 6	31.1	----	----	----	----	----
HA92YK 312 1	4.6	<0.015	<0.030	<0.030	<0.015	----
HA92YK 312 2	52.4	----	----	----	----	----
HA92YK 312 3	4.8	----	----	----	----	----
HA92YK 312 4	4.0	----	----	----	----	----
HA92YK 312 5	6.8	----	----	----	----	<2
HA92YK 312 6	14.6	----	----	----	----	----
PA92YA 705.1 1	4.9	<0.015	<0.030	<0.030	<0.015	----
PA92YA 705.1 2	38.1	----	----	----	----	----
PA92YA 705.1 3	6.9	----	----	----	----	----
PA92YA 705.1 4	36.4	----	----	----	----	----
PA92YA 705.1 5	NSS	----	----	----	----	14
PA92YA 705.1 6	18.7	----	----	----	----	----
PA92YA 705.2 1	4.4	<0.030	<0.060	<0.060	<0.030	----
PA92YA 705.2 2	28.5	----	----	----	----	----
PA92YA 705.2 3	4.7	----	----	----	----	----
PA92YA 705.2 4	6.3	----	----	----	----	----
PA92YA 705.2 5	4.8	----	----	----	----	<2
PA92YA 705.2 6	3.2	----	----	----	----	----
PA92YA 705.5 1	3.4	NSS	NSS	NSS	NSS	----
PA92YA 705.5 2	24.6	----	----	----	----	----
PA92YA 705.5 3	3.6	----	----	----	----	----
PA92YA 705.5 4	2.5	----	----	----	----	----
PA92YA 705.5 5	1.7	----	----	----	----	<2
PA92YA 705.5 6	0.5	----	----	----	----	----

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Yb ppm	Au oz/t	Pt oz/t	Pd oz/t	Rh oz/t	Sn ppm
	NAA	FA - ICP	FA - ICP	FA - ICP	FA - ICP	AAS
PA92YA 706 1	6.3	<0.015	<0.030	<0.030	<0.015	----
PA92YA 706 2	21.2	----	----	----	----	----
PA92YA 706 3	4.9	----	----	----	----	----
PA92YA 706 4	14.8	----	----	----	----	----
PA92YA 706 5	12.7	----	----	----	----	<2
PA92YA 706 6	2.5	----	----	----	----	----
PA92YA 707.2 1	4.3	<0.030	<0.060	<0.060	<0.030	----
PA92YA 707.2 2	24.2	----	----	----	----	----
PA92YA 707.2 3	4.0	----	----	----	----	----
PA92YA 707.2 4	4.4	----	----	----	----	----
PA92YA 707.2 5	3.4	----	----	----	----	<2
PA92YA 707.2 6	2.1	----	----	----	----	----
PA92YA 708.2 1	3.8	<0.015	<0.030	<0.030	<0.015	----
PA92YA 708.2 2	22.9	----	----	----	----	----
PA92YA 708.2 3	4.3	----	----	----	----	----
PA92YA 708.2 4	6.4	----	----	----	----	----
PA92YA 708.2 5	5.5	----	----	----	----	<2
PA92YA 708.2 6	2.7	----	----	----	----	----
PA92YA 715.1 1	2.8	<0.015	<0.030	<0.030	<0.015	----
PA92YA 715.1 2	20.5	----	----	----	----	----
PA92YA 715.1 3	5.2	----	----	----	----	----
PA92YA 715.1 4	3.8	----	----	----	----	----
PA92YA 715.1 5	4.5	----	----	----	----	<2
PA92YA 715.1 6	7.8	----	----	----	----	----
HA92YA 801.1 1	2.2	<0.015	<0.030	<0.030	<0.015	----
HA92YA 801.1 2	31.2	----	----	----	----	----
HA92YA 801.1 3	6.7	----	----	----	----	----
HA92YA 801.1 4	20.0	----	----	----	----	----
HA92YA 801.1 5	NSS	----	----	----	----	<2
HA92YA 801.1 6	95.9	----	----	----	----	----
HA92YA 806.2 1	2.9	<0.015	<0.030	<0.030	<0.015	----
HA92YA 806.2 2	28.3	----	----	----	----	----
HA92YA 806.2 3	7.1	----	----	----	----	----

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Yb ppm	Au oz/t	Pt oz/t	Pd oz/t	Rh oz/t	Sn ppm
	NAA	FA - ICP	FA - ICP	FA - ICP	FA - ICP	AAS
HA92YA 806.2 4	25.6	----	----	----	----	----
HA92YA 806.2 5	10.3	----	----	----	----	<2
HA92YA 806.2 6	42.3	----	----	----	----	----
HA92YA 809.2 1	2.5	<0.015	<0.030	<0.030	<0.015	----
HA92YA 809.2 2	25.3	----	----	----	----	----
HA92YA 809.2 3	7.4	----	----	----	----	----
HA92YA 809.2 4	15.6	----	----	----	----	----
HA92YA 809.2 5	9.1	----	----	----	----	<2
HA92YA 809.2 6	352.0	----	----	----	----	----
HA92YA 827.2 1	1.3	<0.015	<0.030	<0.030	<0.015	----
HA92YA 827.2 2	29.4	----	----	----	----	----
HA92YA 827.2 3	11.7	----	----	----	----	----
HA92YA 827.2 4	23.5	----	----	----	----	----
HA92YA 827.2 5	29.2	----	----	----	----	NSS
HA92YA 827.2 6	105.0	----	----	----	----	----
HA92YA 840.1 1	3.0	<0.015	<0.030	<0.030	<0.015	----
HA92YA 840.1 2	27.9	----	----	----	----	----
HA92YA 840.1 3	6.7	----	----	----	----	----
HA92YA 840.1 4	23.0	----	----	----	----	----
HA92YA 840.1 5	7.2	----	----	----	----	4
HA92YA 840.1 6	44.8	----	----	----	----	----
CH92YA 850.4 1	2.7	<0.015	<0.030	<0.030	<0.015	----
CH92YA 850.4 2	32.1	----	----	----	----	----
CH92YA 850.4 3	7.2	----	----	----	----	----
CH92YA 850.4 4	22.1	----	----	----	----	----
CH92YA 850.4 5	10.3	----	----	----	----	6
CH92YA 850.4 6	110.8	----	----	----	----	----
CH92YA 865.1 1	2.7	<0.015	<0.030	<0.030	<0.015	----
CH92YA 865.1 2	24.0	----	----	----	----	----
CH92YA 865.1 3	5.4	----	----	----	----	----
CH92YA 865.1 4	19.5	----	----	----	----	----
CH92YA 865.1 5	13.4	----	----	----	----	2
CH92YA 865.1 6	35.8	----	----	----	----	----

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Yb ppm	Au oz/t	Pt oz/t	Pd oz/t	Rh oz/t	Sn ppm
	NAA	FA - ICP	FA - ICP	FA - ICP	FA - ICP	AAS
CH92YA 865.2 1	1.9	<0.015	<0.030	<0.030	<0.015	----
CH92YA 865.2 2	27.9	----	----	----	----	----
CH92YA 865.2 3	7.0	----	----	----	----	----
CH92YA 865.2 4	24.6	----	----	----	----	----
CH92YA 865.2 5	NSS	----	----	----	----	4
CH92YA 865.2 6	79.5	----	----	----	----	----
CH92YA 865.4 1	4.7	<0.030	<0.060	<0.060	<0.030	----
CH92YA 865.4 2	14.3	----	----	----	----	----
CH92YA 865.4 3	4.3	----	----	----	----	----
CH92YA 865.4 4	8.6	----	----	----	----	----
CH92YA 865.4 5	6.5	----	----	----	----	2
CH92YA 865.4 6	2.4	----	----	----	----	----
CH92YA 866 1	1.1	<0.015	<0.030	<0.030	<0.015	----
CH92YA 866 2	23.5	----	----	----	----	----
CH92YA 866 3	15.0	----	----	----	----	----
CH92YA 866 4	13.9	----	----	----	----	----
CH92YA 866 5	17.6	----	----	----	----	NSS
CH92YA 866 6	146.0	----	----	----	----	----
HA92YA 833.1 1	4.9	<0.015	<0.030	<0.030	<0.015	----
HA92YA 833.1 2	23.0	----	----	----	----	----
HA92YA 833.1 3	5.7	----	----	----	----	----
HA92YA 833.1 4	9.8	----	----	----	----	----
HA92YA 833.1 5	10.9	----	----	----	----	<2
HA92YA 833.1 6	5.7	----	----	----	----	----
HA92YA 883.2 1	5.6	<0.030	<0.060	<0.060	<0.030	----
HA92YA 883.2 2	14.7	----	----	----	----	----
HA92YA 883.2 3	5.8	----	----	----	----	----
HA92YA 883.2 4	5.5	----	----	----	----	----
HA92YA 883.2 5	4.3	----	----	----	----	<2
HA92YA 883.2 6	1.2	----	----	----	----	----
HA92YA 890.1 1	5.5	<0.015	<0.030	<0.030	<0.015	----
HA92YA 890.1 2	16.7	----	----	----	----	----
HA92YA 890.1 3	5.6	----	----	----	----	----

See Appendix A for map numbers.

Appendix D. -- Analytical results for magnetic fractions from characterized samples

Sample	Yb ppm	Au oz/t	Pt oz/t	Pd oz/t	Rh oz/t	Sn ppm
	NAA	FA - ICP	FA - ICP	FA - ICP	FA - ICP	AAS
HA92YA 890.1 4	8.6	----	----	----	----	----
HA92YA 890.1 5	8.2	----	----	----	----	2
HA92YA 890.1 6	2.8	----	----	----	----	----

Appendix E. -- Results of ilmenite grain analyses for four magnetic fractions of the Cape Yakataga and Yakutat area samples

Sample	-200 mesh			Ferromagnetic			0.05 A			0.15 A			0.30 A		
number	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn
Cape Yakataga Area (92YK) Samples															
CH 029.1				44	45	6	57	41	1	46	49	2			
							47	46	3	42	50	8			
							55	44	0	48	51	1			
							53	44	1	48	50	2			
							48	50	1	44	50	6			
							52	45	1	51	49	0			
							50	46	3	43	52	5			
CH 029.2				49	47	3	72	28	0	48	48	4			
				49	49	1	70	30	0	41	56	3			
							50	28	1	47	49	4			
							66	34	0	46	50	4			
							50	49	1	48	49	3			
							83	17	0	84	16	0			
							50	49	1	29	71	0			
							96	4	0						
CH 113				55	26	0	49	48	3	49	48	3			
				64	27	0	51	46	3	84	16	0			
				76	14	1	45	44	2	54	45	1			
				91	9	0	53	47	0	87	13	0			
							49	47	2	51	46	3			
							48	47	3						
							42	46	4						
							6	93	0						
CH 148				74	19	0	78	15	1	85	15	0			
				41	46	3	52	46	2	89	11	0			
				70	15	1	91	10	0	52	46	2			
				48	19	0	8	92	0	55	45	0			
				62	22	0	50	47	2	48	50	2			
				58	26	0	51	47	2						
				49	49	0									
				70	21	0									
CH 155				70	30	0	43	40	1	82	18	0			
				62	29	0	45	37	4	17	83	0			
				69	31	0	38	37	3	45	54	1			
				66	28	1	36	38	4	47	51	2			
							22	78	0	83	17	0			
							39	36	1	44	53	3			
							26	29	2	44	54	2			
							51	44	2						
							93	7	0						
							49	45	3						
CH 164				63	22	1	40	37	3	44	54	2			
				44	44	4	54	43	3	44	54	2			
							57	43	0	40	54	6			
							51	47	2	45	53	2			
							51	46	3	46	53	1			
							50	47	3						
							50	48	2						
							83	17	0						
							40	39	2						
CH 166				50	45	2	72	11	0	48	50	2			
				72	19	0	79	5	0	49	50	1			
							75	5	0	50	50	0			
							49	40	1	44	53	3			
							49	40	0	53	47	0			
							46	41	2						
							46	41	2						
							43	42	6						

Percent shown is atomic percent (%) less oxygen.

Appendix E. -- Results of ilmenite grain analyses for four magnetic fractions of the Cape Yakataga and Yakutat area samples

Sample number	-200 mesh			Ferromagnetic			0.05 A			0.15 A			0.30 A		
	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn
CH 166							47	36	1						
							71	16	0						
							74	11	0						
							76	9	0						
							47	37	0						
CH 170.1				95	5	0	33	45	0	50	51	0			
				47	51	2	59	12	0	45	50	5			
				80	18	2	40	36	1	44	50	6			
				33	60	7	40	43	11	49	46	5			
				66	34	0	50	48	2	84	16	0			
							45	44	3	56	44	0			
							55	45	0	48	49	3			
CH 170.3				77	23	0	51	43	0	51	47	2			
				88	10	0	47	47	3	45	50	5			
				54	41	4	47	41	0	43	53	4			
				75	25	0	40	37	5	50	50	0			
				11	57	0	54	46	0	48	50	2			
				45	49	5	48	50	2	50	50	0			
				66	34	0	50	49	1						
							35	39	2						
CH 174				78	20	2	48	46	2	46	50	4			
				71	27	1	47	45	3	48	52	0			
				79	20	1	51	48	1	51	49	0			
				48	47	5	49	47	4	50	49	1			
				68	30	2	51	47	2	44	50	6			
				48	50	2	50	47	3	48	49	3			
							10	72	0	48	50	2			
							49	47	4						
							52	46	2						
HA 111				49	50	1	52	47	1	45	50	5			
				76	23	1	43	49	8	48	50	2			
				68	19	0	5	71	1	46	48	6			
				75	10	0	79	19	2	6	94	0			
				62	36	2	51	49	0	80	20	0			
				51	47	2	84	16	0	45	55	0			
							54	45	1						
							55	45	0						
							52	46	2						
							87	13	0						
							46	54	0						
							86	14	0						
							59	35	6						
							23	77	0						
HA 123				17	83	0	49	50	1	53	46	1			
				94	6	0	95	5	0	49	49	2			
				49	48	3	89	11	0	49	48	3			
				71	29	0	59	38	3	46	50	4			
							48	49	3	55	44	1			
										49	50	1			
HA 145				50	48	2	48	46	3	44	56	0			
				48	48	4	48	46	3	57	43	0			
				45	53	2	42	55	3	44	52	4			
				91	9	0	50	47	3	47	49	4			
				48	49	3	50	47	3	49	50	1			
				47	47	2	48	49	3	48	50	2			
							47	48	5	84	16	0			
HA 180				77	23	0	52	46	2	49	49	2			
				45	49	6	54	45	1	48	50	2			
				49	48	3	48	49	3	46	48	6			

Percent shown is atomic percent (%) less oxygen.

Appendix E. -- Results of ilmenite grain analyses for four magnetic fractions of the Cape Yakataga and Yakutat area samples

Sample number	-200 mesh			Ferromagnetic			0.05 A			0.15 A			0.30 A		
	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn
HA 180				47	49	4	50	46	4	66	31	3			
							5	95	0	53	45	2			
										48	47	5			
Mean				60.4	33.7	1.5	51.9	40.9	1.7	51.1	46.7	2.1			
Mean Fe/Ti					1.791			1.270			1.094				
Yakutat Area (92YA) Samples															
PA 701.1	50.0	47.0	3.0	51	47	2	50	47	3	50	48	2	49	49	2
	85.0	15.0	0.0	23	77	0	54	44	2	53	45	2	44	51	5
	21.0	79.0	0.0	78	22	0	50	47	3	88	12	0			
	51.0	47.0	2.0	51	45	4	51	47	2	47	50	3			
	49.0	48.0	3.0	48	50	2	49	48	3	47	50	3			
	88.0	12.0	0.0	47	49	4	9	91	0	88	12	0			
	45.0	48.0	7.0				91	9	0	57	41	2			
	51.0	49.0	0.0				53	47	0	49	49	2			
PA 705.4	51.0	47.0	2.0	50	47	3	52	46	2	49	50	1			
	62.0	32.0	6.0	44	51	5	46	48	6	47	50	3			
	88.0	12.0	0.0	2	98	0	48	50	2	50	48	2			
	47.0	47.0	6.0	88	12	0	3	97	0	37	48	15			
	54.0	44.0	2.0	52	47	1	86	14	0	74	25	1			
	84.0	16.0	0.0	6	94	0	48	50	2	85	14	1			
	52.0	46.0	2.0	96	4	0	49	48	3	48	50	2			
										48	50	2			
PA 707.1	54.0	43.0	3.0	49	50	1	48	47	5	46	50	4	40	52	8
	57.0	41.0	2.0	83	17	0	51	47	2	49	49	2	48	52	0
	49.0	49.0	2.0	84	16	0	51	47	2	86	13	1	45	50	5
	49.0	50.0	1.0	23	77	0	89	11	0	50	47	3	47	47	6
	51.0	47.0	2.0	12	88	0	64	36	0	46	50	4	48	49	3
	49.0	50.0	1.0	89	11	0	52	45	3	47	51	2	45	51	4
	45.0	45.0	10.0	51	47	2	28	72	0	48	50	2			
	48.0	50.0	2.0				51	45	4	47	50	3			
PA 707.2	48.0	48.0	4.0	5	95	0	57	40	3	49	50	1	50	45	5
	50.0	49.0	1.0	97	3	0	52	47	1	51	46	3	40	49	11
	52.0	46.0	2.0	51	47	2	56	41	3	89	11	0			
	69.0	28.0	3.0	89	11	0	88	12	0	50	48	2			
	50.0	46.0	4.0	50	48	2	50	48	2	49	49	2			
	52.0	44.0	4.0	49	48	3	51	46	3	46	50	4			
	49.0	49.0	2.0	84	16	0	43	50	7	87	12	1			
	51.0	47.0	2.0	47	53	0	48	46	6	84	16	0			
PA 708.1	48.0	50.0	2.0	55	45	0	84	16	0	47	49	4	47	51	2
	85.0	14.0	1.0	49	48	3	58	40	2	86	14	0	50	48	2
	50.0	48.0	2.0	89	10	1	56	41	3	48	46	6	45	50	5
	50.0	46.0	4.0	45	48	7	51	47	2	53	46	1			
	49.0	48.0	3.0	27	73	0	10	90	0	84	16	0			
	40.0	58.0	2.0	96	4	0	52	48	0	46	47	7			
	50.0	48.0	2.0	50	46	4	47	50	3	25	74	1			
	51.0	45.0	4.0				48	49	3	46	50	4			
PA 715.2	47.0	50.0	3.0	51	48	1	50	48	2	47	50	3	48	50	2
	44.0	49.0	7.0	13	87	0	51	48	1	48	50	2	36	50	14
	52.0	46.0	2.0	85	15	0	52	46	2	46	50	4	47	50	3
	19.0	81.0	0.0	53	43	4	27	73	0	47	48	5	47	50	3
	49.0	48.0	3.0	76	24	0	63	36	1	49	50	1	47	50	3
	47.0	49.0	4.0	46	48	6	56	43	1	48	47	5	46	50	4
	49.0	48.0	3.0	48	49	3	51	47	2	49	50	1			
				89	11	0	50	47	3	84	16	0			
PA 715.3	48.0	50.0	2.0	49	48	3	53	46	1	49	49	2	46	51	3
	48.0	49.0	3.0	5	95	0	91	9	0	50	48	2	47	50	3
	17.0	83.0	0.0	88	11	1	56	42	2	46	50	4	46	50	4
	52.0	47.0	1.0	48	44	8	50	47	3	48	49	3	48	50	2
	46.0	50.0	4.0	53	45	2	49	48	3	52	45	3	46	50	4

Percent shown is atomic percent (%) less oxygen.

Appendix E. -- Results of ilmenite grain analyses for four magnetic fractions of the Cape Yakataga and Yakutat area samples

Sample number	-200 mesh			Ferromagnetic			0.05 A			0.15 A			0.30 A		
	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn
PA 715.3	47.0	52.0	1.0	80	20	0	49	49	2	50	48	2			
	48.0	50.0	2.0	50	48	2	55	43	2	82	17	1			
	52.0	47.0	1.0				53	45	2	49	49	2			
HA 802				5	95	0	50	47	3	48	50	2	33	51	16
				92	8	0	53	45	2	51	46	3	48	50	2
				9	91	0	82	17	1	46	50	4	47	49	4
				40	49	11	53	46	1	47	50	3	47	50	3
				81	18	1	53	45	2	50	48	2	48	50	2
				48	47	5	50	47	3	46	50	4			
				46	50	4	49	48	3	52	45	3			
				20	80	0				50	48	2			
HA 803.1				50	47	3	48	45	7	48	50	2	45	51	4
				85	15	0	51	46	3	46	48	6	46	50	4
				46	48	6	19	81	0	48	51	1	46	50	4
				46	47	7	58	41	1	45	50	5	46	50	4
				9	91	0	48	48	4	48	50	2	36	50	14
				14	86	0	54	44	2	50	49	1			
				73	26	1	52	46	2	50	49	1			
				58	39	3	48	47	5	48	50	2			
HA 812.1				82	18	0	54	44	2	44	50	6	45	51	4
				3	97	0	43	47	10	50	48	2	44	51	5
				46	50	4	14	86	0	47	50	3	47	50	3
				5	95	0	50	47	3	46	53	1	45	51	4
				44	49	7	50	49	1	46	50	4	48	50	2
				48	49	3	50	47	3	46	51	3			
							51	47	2	46	50	4			
										51	47	2			
HA 827.1				50	47	3	51	47	2	48	50	2	47	51	2
				48	49	3	51	47	2	48	50	2	50	48	2
				50	48	2	44	48	8	47	51	2	47	49	4
				53	46	1	44	48	8	47	50	3	44	50	6
				83	17	0	20	80	0	49	49	2	45	50	5
				7	93	0	89	11	0	85	15	0			
				51	49	0	55	43	2	50	47	3			
							51	47	2	47	50	3			
HA829.1				57	41	2	51	47	2	46	50	4	48	49	3
				83	15	2	49	48	3	84	16	0	44	50	6
				19	81	0	51	47	2	52	45	3	47	51	2
				44	48	8	47	45	8	9	91	0	48	50	2
				17	83	0	52	47	1	92	8	0	46	51	3
				48	48	4	52	47	1	47	50	3			
				98	2	0	53	43	4	50	49	1			
				52	47	1	51	46	3	45	50	5			
HA 834.2				49	46	5	51	48	1	17	82	1	41	52	7
				52	46	2	54	45	1	53	45	2	44	50	6
				53	46	1	2	98	0	45	51	4	42	50	8
				53	46	1	93	7	0	45	51	4	45	50	5
				46	46	8	51	48	1	57	40	3	43	51	6
				5	95	0	53	45	2	90	10	0			
				51	48	1	51	47	2	47	50	3			
				52	45	3	48	48	4	47	50	3			
HA 837.2				98	2	0	52	46	2	48	50	2	46	51	3
				2	98	0	53	45	2	48	49	3	50	45	5
				48	50	2	84	16	0	84	16	0	46	50	4
				55	44	1	84	16	0	50	49	1	48	50	2
				85	15	0	41	50	9	46	50	4	45	50	5
				54	43	3	52	46	2	47	50	3			
				83	17	0	88	12	0	47	50	3			
							48	48	4	50	48	2			

Percent shown is atomic percent (%) less oxygen.

Appendix E. -- Results of ilmenite grain analyses for four magnetic fractions of the Cape Yakataga and Yakutat area samples

Sample number	-200 mesh			Ferromagnetic			0.05 A			0.15 A			0.30 A		
	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn	% Fe	% Ti	% Mn
HA 849				53	42	5	47	49	4	49	48	3	46	51	3
				51	47	2	49	47	4	42	49	9	48	51	1
				18	82	0	85	15	0	17	82	1	46	49	5
				49	47	4	53	46	1	89	11	0	46	51	3
				80	19	1	52	45	3	50	49	1	45	49	6
				54	45	1	76	23	1	48	50	2			
				53	45	2	48	49	3	46	50	4			
							50	46	4	47	52	1			
HA 862.1				48	51	1	49	48	3	47	50	3	47	50	3
				52	45	3	51	47	2	85	14	1	45	50	5
				3	97	0	49	45	6	83	17	0	47	50	3
				85	15	0	89	11	0	86	14	0	45	50	5
				48	48	4	55	45	0	48	50	2	48	50	2
				50	51	0	52	46	2	47	50	3			
				78	22	0	52	44	4	43	50	7			
				12	88	0	84	16	0	84	15	1			
CH 865.3				47	47	6	50	47	3	89	11	0	46	50	4
				7	93	0	51	47	2	47	50	3	48	49	3
				83	17	0	51	47	2	47	50	3	46	51	4
				11	89	0	49	44	7	48	51	2	47	50	3
				49	51	0	88	12	0	46	51	3	46	50	4
				51	47	3	24	76	0	49	50	2			
				51	45	4	51	47	2	49	50	1			
										49	50	1			
Mean	51.6	45.9	2.5	50.6	47.6	1.8	52.9	44.8	2.3	53.5	44.1	2.4	45.7	50.0	4.3
Mean Fe/Ti		1.126			1.062			1.180			1.212			0.915	

Mean Fe/Ti for all analyzed Cape Yakataga ilmenite: 1.385
Mean Fe/Ti for all analyzed Yakutat ilmenite: 1.099

Percent shown is atomic percent (%) less oxygen.