Mineral Resource Assessment of Selected Areas in Clark and Nye Counties, Nevada, Edited by Steve Ludington
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Chapter F. Mineral Resource Potential of the Ash Meadows and Amargosa Mesquite Trees Areas of Critical Environmental Concern, Nye County, Nevada

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Summary and Conclusions

The Ash Meadows Area of Critical Environmental Concern (ACEC) contains known deposits of montmorillonite clay and zeolite that have been mined in the past. Two areas in the southern part of the ACEC have high potential for the occurrence of zeolite deposits on the basis of field evaluation and samples collected during this study. Extensive areas in the northern and western parts of this ACEC have high potential for the occurrence of montmorillonite clay deposits. Important deposits of sepiolite and saponite clay are mined by IMV Nevada in a 4-km-wide corridor between the Ash Meadows and Amargosa Mesquite Trees ACECs. Three areas that include parts of both ACECs have high potential for the occurrence of such clay deposits, although IMV Nevada has dropped most of the claims within the ACECs.

There is no potential for the occurrence of other deposits of locatable or leasable minerals in either ACEC.

The Ash Meadows ACEC has areas with high, moderate, and low potential for the occurrence of crushed-stone aggregate deposits. There are areas of both high and low potential for the occurrence of sand and gravel aggregate deposits.

The Amargosa Mesquite Trees ACEC has no potential for the occurrence of crushed-stone deposits. There are areas of both high and low potential for the occurrence of sand and gravel aggregate deposits.

Introduction

This report was prepared for the U.S. Bureau of Land Management (BLM) to provide information for land planning and management, and, specifically, to determine mineral resource potential in accordance with regulations at 43 CFR 2310, which governs the withdrawal of public lands. The Clark County Conservation of Public Land and Natural Resources Act of 2002 temporarily withdraws the lands described herein from mineral entry, pending final approval of an application for permanent withdrawal by the BLM. This report provides information about mineral resource potential on these lands.

The Ash Meadows and Amargosa Mesquite Trees ACECs were studied in the field to confirm descriptions of the geology that were gleaned from the scientific literature. Samples were collected and analyzed, and representatives of the companies with mining operations in and near the areas were contacted.

Definitions of mineral resource potential and certainty levels are given in appendix 1 and are similar to those outlined by Goudarzi (1984).

Lands Involved

The Ash Meadows ACEC and the Amargosa Mesquite Trees ACEC were combined in this chapter because they have similar geology and mineral resource potential and they are in close proximity. The ACECs are in Nye County, southwest of Highway 95 and east of Nevada State Highway 373 and the community of Amargosa Valley. The Ash Meadows ACEC surrounds the Ash Meadows National Wildlife Refuge, and its southwest edge lies along the Nevada-California border. A mineral report was prepared before the withdrawal of the wildlife refuge from mineral entry (Wallace, 1999). Ash Meadows ACEC also surrounds the Devils Hole area, a small satellite of Death Valley National Park. The ACECs can be accessed by various secondary and primitive roads that extend eastward from Highway 373. A legal description of these lands is included in appendix 2.

Physiographic Description

The Ash Meadows ACEC consists mainly of Ash Meadows, a low-lying, spring-fed wetland area that ranges between about 640 m and 700 m in elevation. The wetlands lie in the Amargosa Desert, a broad intermontane basin that drains southward, via the Carson Slough, into the Amargosa River and eventually into Death Valley. The Ash Meadows wetland area flanks hills that reach elevations of as much as 960 m within the ACEC. The Amargosa Mesquite Trees ACEC is at elevations of 730 m to 780 m in a transitional bajada-playa environment along the east side of Amargosa Flat, an alkali

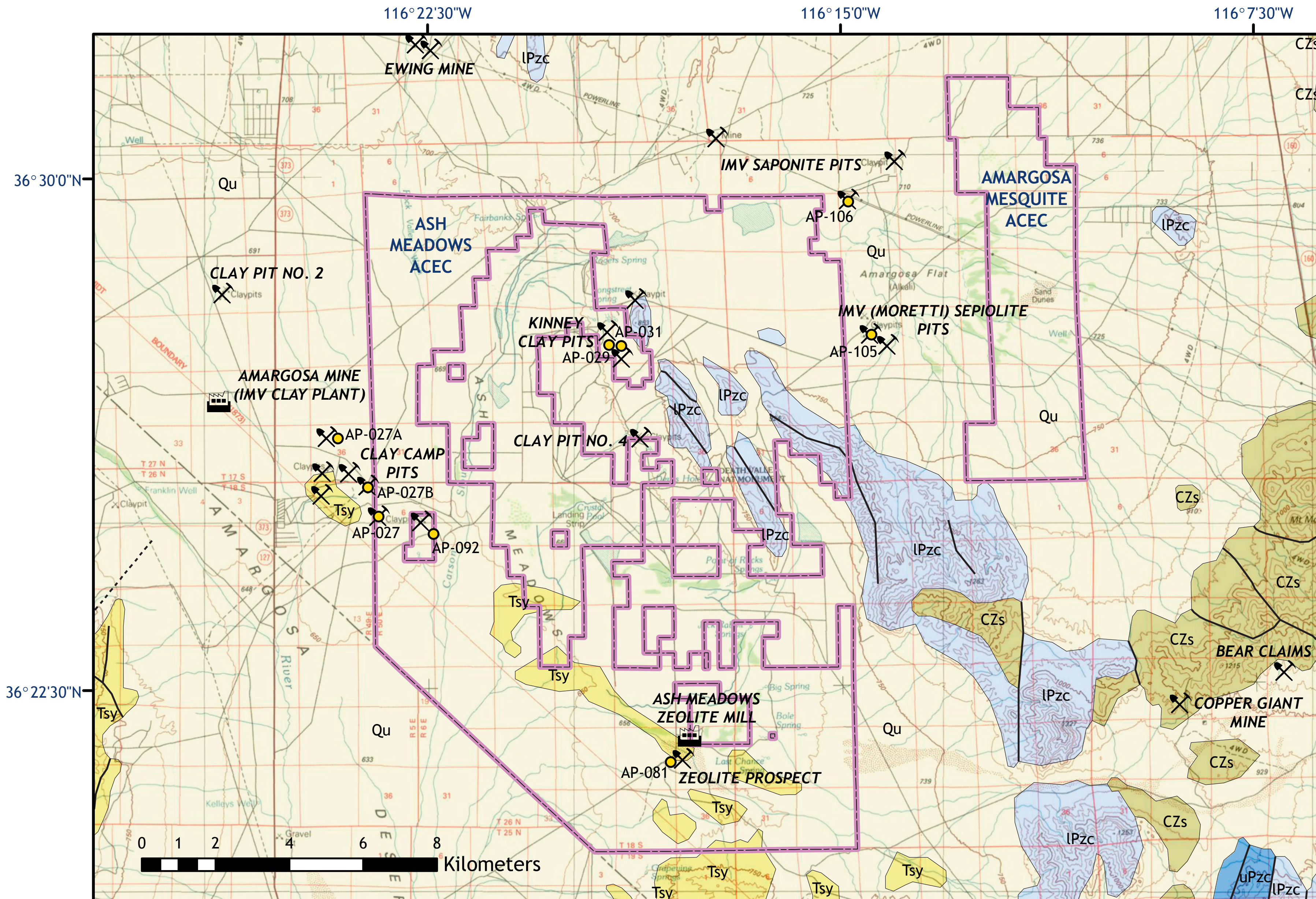


Figure 1. Generalized geology of the Amargosa Mesquite Trees and Ash Meadows Areas of Critical Environmental Concern (ACEC), showing mines, prospects, and location of analyzed samples. Geology modified from Stewart and Carlson (1978). See explanation on page F3.

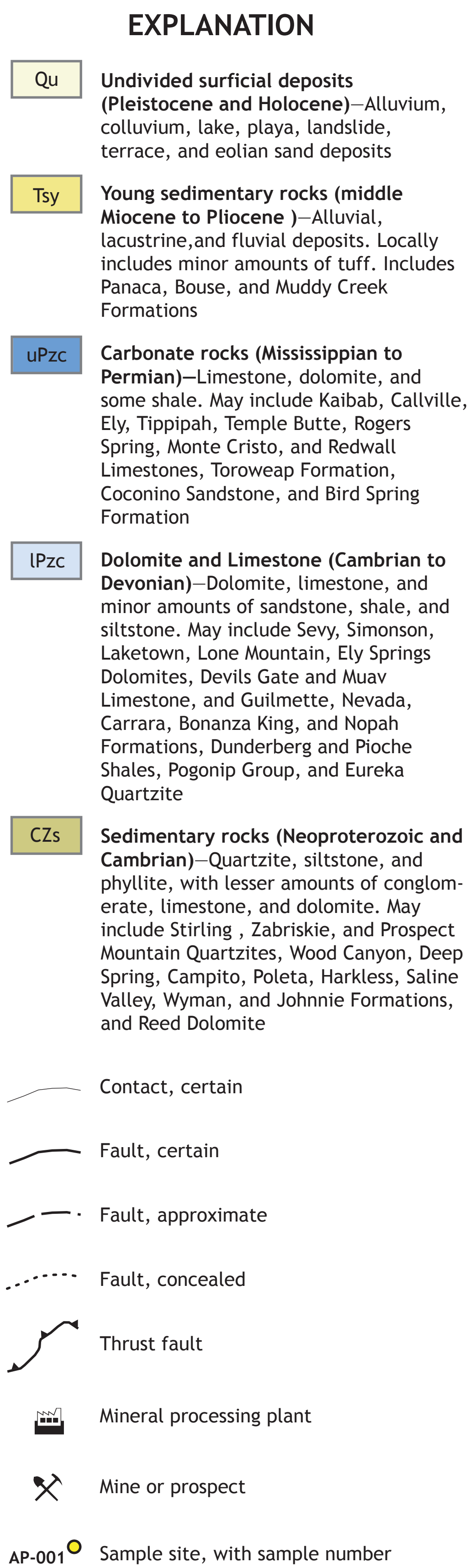


Figure 1.—Continued.

playa. The Amargosa Flat playa drains westward into the north part of the Ash Meadows wetlands.

Geologic Setting

The Ash Meadows and Amargosa Mesquite Trees ACECs are in the Amargosa Desert, a northwest-trending structural basin in the Basin and Range Physiographic Province. The Amargosa Desert occupies an area between the north-trending basin and range structures to the northeast, and northwest-trending structures of the Walker Lane belt to the southwest. The Walker Lane belt is a zone of diverse topography and strike-slip faulting caused mostly by late Tertiary to modern extension (Stewart, 1992). Miocene to modern extensional tectonism created northwest-trending ranges and valleys in the Death Valley region to the southwest.

Geology

Lower Paleozoic (Cambrian) rocks underlie the hills in and near the Ash Meadows and Amargosa Mesquite ACECs (fig. 1). The oldest rocks are in the Bonanza King Formation, which is mostly dolomite with some limestone. Parts of the unit contain silty to sandy layers (Cornwall, 1972). Shale and carbonate rocks of the Nopah Formation overlie the Bonanza King Formation at the north end of the hills.

Rhyolitic tuffs and sedimentary rocks of Miocene and Pliocene age crop out in the southern part of the Ash Meadows ACEC. These rocks may be part of 16- to 10-Ma volcanic deposits of the southwestern Nevada volcanic field (Sawyer and others, 1994), and may also include younger rocks. They are widely zeolitized, and the zeolitized tuffs are overlain by siltstones, limestones, and tuffs, similar to the 7- to 5-Ma Furnace Creek Formation (Fleck, 1970).

Most of the Ash Meadows ACEC is underlain by Pliocene lacustrine and spring silt, clay, and carbonate deposits, which are covered by thin Quaternary deposits. Tuffs in the Pliocene strata have K-Ar and fission track ages of 3.2 to 2.1 Ma (Hay and others, 1986).

In the Amargosa Mesquite Trees ACEC, Quaternary deposits are the only geologic units exposed, but drilling there by IMV Nevada has shown that Pliocene clay and carbonate deposits are present at shallow depth.

Mining History

The mining history in the area of the Ash Meadows and Amargosa Mesquite Trees ACECs primarily involves clay mining in the Ash Meadows mining district. A large part of Nevada's industrial clay has come from this district, and we estimate total clay production from the district at more than 1 million short tons. Clay was discovered in the district in 1917, and mining began in 1918 (Kral, 1951). Early clay production in the district was mainly of fuller's earth used to decolorize and filter oils, but it also included some bentonite used in drilling mud (Papke, 1970). Most of the mining was in the Clay Camp area just west of the Ash Meadows ACEC (fig. 1), where the clay was mined by dragline excavation. It was dried, crushed, sized, and sacked at Clay Camp and shipped by rail. Recorded production through 1949 was about 180,000 short tons; however, this total is probably low because more than 34,000 short tons were produced in 1929 alone (Kral, 1951). U.S. Bureau of Mines (USBM) records indicate that clay production ceased in 1954, which probably marked the end of clay mining in the Clay Camp area.

In the 1970s, Industrial Minerals Ventures (IMV) began clay mining again in the Ash Meadows district. Clay produced by this operation in the 1970s and 1980s was listed as fuller's earth and bentonite by the USBM. Dragline trenching of sepiolite at the Moretti deposit (fig. 1) in the Amargosa Flat area was noted by Papke (1972), and both bentonite and sepiolite were being mined by 1980 (Papke, 1981). Saponite clay production began in the 1990s from deposits a few kilometers north of the sepiolite operation. In the 1990s, Rio Tinto PLC acquired IMV, and in 1997, the current owner, Mud Camp Mining Co. LLC, acquired IMV from Rio Tinto. In 2002, about 30,000 short tons of sepiolite, saponite, and bentonite were produced by IMV at a processing plant in Amargosa Valley (Castor, 2003). Production in 2003 and 2004 was about 33,200 and 32,600 short tons, respectively (Driesner and Coyner, 2004, 2005). The company exports a variety of clay products worldwide and is the only producer of sepiolite and saponite in the United States.

In addition to clay mining, small amounts of zeolite have been produced from the Ash Meadows ACEC. A Union Carbide geologist discovered zeolite in 1960, and in 1973 a similar deposit was discovered a few kilometers to the south in California. Anaconda Minerals Co. acquired both deposits in the 1970s, and they were subsequently leased to Zeolite International Inc., who began mining in the 1980s. A processing plant (fig. 1) on private land that is surrounded by the Ash Meadows ACEC has been shipping zeolite, mostly mined from the California deposit, since the 1980s. The current operator, Ash Meadows Zeolite LLC, a subsidiary of Badger Mining Corp., ships 1,000 to 2,000 short tons annually of zeolite used in water filtration, odor control, and nuclear clean-up (Castor, 2003).

Mineral Deposits

Clay Deposits

Clay deposits occur in and around the Ash Meadows ACEC and adjacent to the Amargosa Mesquite Trees ACEC. These deposits may be subdivided into montmorillonite, saponite, and sepiolite deposits on the basis of the main clay mineral commodity; however, more than one type of clay may be found in some of the deposits. Montmorillonite is sodium and (or) calcium smectite. Sodium-rich montmorillonite is typically a high-swelling clay that is used in drilling mud, scoopable cat litter, and in other applications that require high swelling capacities. Calcium-rich montmorillonite is generally used where swelling capacities are less important, as in foundry bonding clay. Saponite is magnesium-rich smectite. It is related to the more common montmorillonite, but is chemically and structurally distinct. Sepiolite is a rare fibrous clay that is used in salt-water and geothermal drilling muds, cat litter, and absorbent products. It is commonly included with palygorskite (attapulgite) in the hormite group of clay minerals (Heivilin and Murray, 1994). About 80 percent of the clay mined by IMV Nevada is sepiolite.

Clay Camp Deposits

Ash Meadows mining operations that produced clay between 1918 and 1954 mainly exploited deposits directly west of the Ash Meadows ACEC and north of the Clay Camp ruins (fig. 1). According to Kral (1951), these deposits were as much as 100 feet (30 m) in diameter, and were mined to a depth of 24 feet (7 m); a high water table in this area precluded deeper extraction. Exposures in a number of places indicate that about 2 m of carbonate-rich overburden overlies the useable clay. Excellent quality white montmorillonite is reportedly still present in one pit as a lens-shaped body 30 feet (9 m) long and 1.5 feet (45 cm) thick that is underlain by an unknown thickness of fair-quality clay (Papke, 1970). Kral (1951) described the clay mineral from these deposits as montmorillonite and reported that the clay was used for both fuller's earth and in drilling mud. However, on the basis of analyses by Papke (1970), clay sampled from this area swelled only slightly and the dominant clay mineral is saponite. Small pits and prospects extend east from the Clay Camp area into the Ash Meadows ACEC. A sample (AP-027) from a 2-m-thick clay bed in a small pit (fig. 2) inside the ACEC and about 150 m from its western border contains saponite clay with feldspar, dolomite, and quartz as impurities on the basis of X-ray diffraction (XRD) analysis. Chemical analysis of this sample (Ludington and others, 2005) yields MgO/CaO of 3.7, indicating that this is a magnesium-rich clay because this ratio exceeds the MgO/CaO for dolomite. A sample of pale-brown nonswelling clay from a small pit 1.5 km within the Ash Meadows ACEC on a private inholding was found to contain saponite clay with quartz, feldspar, and illite impurities. This sample (AP-092) has extreme MgO/CaO (Ludington and others, 2005) and no dolomite, indicating that it contains relatively large amounts of saponite.

Saponite Pits

Smectite clay is currently mined by IMV Nevada from pits that lie just northeast of the Ash Meadows ACEC and just west of the Amargosa Mesquite Trees ACEC (fig. 1). The pits are shallow (fig. 3) and exploit clay-rich beds that range from a few centimeters to 6 m thick, occur over a wide area, and appear to be nearly continuous (Wahl and Papke, 2004). The average thickness is about 5 feet (1.5 m), and the average overburden thickness is about 7 feet (2 m). According to Wahl and Papke, the dominant clay mineral here is saponite. Khoury and others (1982) and Hay and others (1986) reported mixtures of stevensite (a magnesian clay mineral) and kerolite (a talc variety) from this area. However, their samples were not taken from the pits from which clay is currently mined and marketed as saponite. XRD analysis of samples that we collected from an active clay pit in this area shows significant amounts of dolomite and a little halite as impurities in the clay. Although nonglycolated XRD analysis of our samples indicates the presence of sepiolite and possible saponite, glycolated patterns give a strong response for an expansive smectite clay such as saponite (glycolation causes distinctive expansion of the mineral lattice in some clay minerals that is measurable by XRD; in sepiolite there is no lattice change, but glycolation of a smectite clay such as saponite causes a distinctive peak shift).

Figure 2. Location of clay channel sample AP-027 in small pit east of Clay Camp.

Chemical analyses (samples AP-106 and AP-106HG; Ludington and others, 2005) show MgO/CaO of 1.1 to 1.7, indicating that the clay is magnesium-rich. It is beyond the scope of this study to make a definitive mineralogic determination, but the clay has been marketed as saponite for many years and most of our data support the saponite identification.

Sepiolite Pits

The only source of commercial sepiolite in the United States is on Amargosa Flat in a 2.5-mile-wide corridor between the Ash Meadows and Amargosa Mesquite Trees ACECs. Here sepiolite occurs in a nearly continuous and essentially horizontal bed as much as 20 feet (6 m) thick, with an average thickness of 6 feet (2 m). It lies below 10-25 feet (3–8 m) of overburden (Wahl and Papke, 2004). The sepiolite bed occurs within the saponite-bearing sequence described above. Impurities in the sepiolite clay include dolomite, calcite, quartz, feldspar, volcanic glass, and traces of other clays (Wahl and Papke, 2004). We took two samples of sepiolite from an operating pit (figs. 4 and 5). One, a 30-cm channel sample from a 30- to 60-cm-thick high-grade bed, was nearly pure sepiolite with a trace of dolomite (sample AP-105). Another was a grab sample of medium-grade sepiolite from below the high-grade bed (sample AP-105A). Samples of clay-rich beds from above and below the sepiolite (AP-105B and AP-105C, respectively) contain minor amounts of montmorillonite clay, as does a nearby surface sample near the boundary of the Ash Meadows ACEC.

Kinney Mine

Clay has been mined from two pits and one underground operation in the Kinney Mine area (fig. 1), which is within the Ash Meadows ACEC. The clay occurs in a gently westward sloping bench that is capped by limestone. The two pits, a western pit (fig. 6) and an eastern pit (fig. 7), are each about 200 m in diameter and expose a 2- to 3-m-thick bed of clay

Figure 3. Shallow saponite pit 0.5 km northwest of the Ash Meadows ACEC.

Figure 4. Belly dump mining of overburden in an IMV Nevada sepiolite pit; overburden in this area is about 5 m thick.

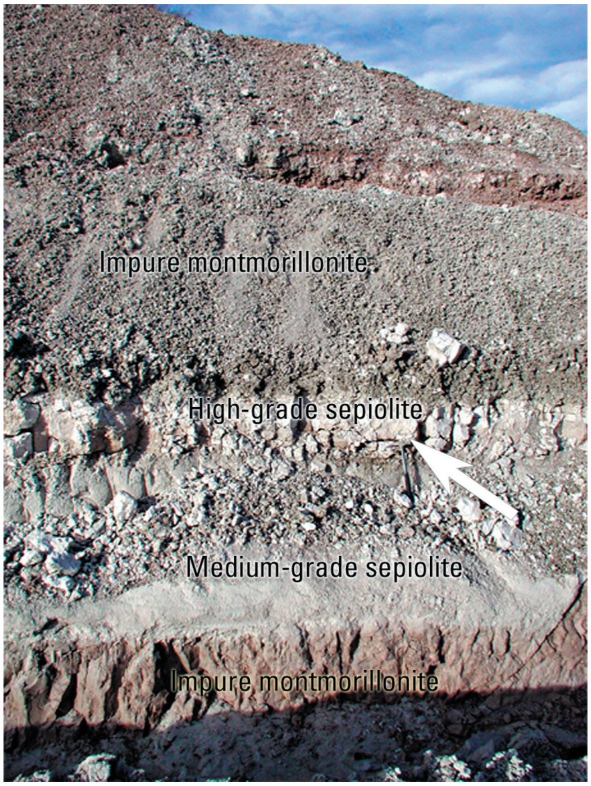


Figure 5. Pale pinkish-gray high-grade sepiolite bed (above and behind hammer head, see white arrow) about 30 cm thick (sample AP-105), lying above light-gray medium-grade sepiolite about 1 m thick (sample AP-105A). Greenish-gray bed (sample AP-105B) above sepiolite and light brownish-gray bed (sample AP-105C) below it are impure montmorillonite clay. IMV Nevada sepiolite pit.

Figure 6. West Kinney Pit looking east. Sample AP-029 is from the southwest corner of the pit.

Figure 7. East Kinney Pit looking northeast. Sample AP-031 was taken from the east wall of the pit.

that is overlain in most places by 1–4 m of bedded limestone. Samples of clay from these pits contain variable amounts of quartz, potassium feldspar, and calcite as impurities. Chemical analysis (Ludington and others, 2005) suggests that the clays are magnesium-rich (AP-029 and AP-031). The best identification for an unexpanded sample by XRD analysis is montmorillonite; however, the chemical analysis suggests that it is saponite. XRD analysis following glycolation shows expansion to 17 Å, which is appropriate for smectite. Papke (1970) described clay in this area, which he referred to as East Ash Meadows, as similar to clay from the Main Ash Meadows (Clay Camp) district. He reported that white montmorillonite from approximately the same location as our sample AP-031 (fig. 8), unlike the saponite at Clay Camp, had good swelling ability and high plastic viscosity. Melhase (1926) described underground clay mining in this area, but production was probably small (Papke, 1970).

Ewing Mine

Montmorillonite clay has been mined by IMV Nevada from pits in the Ewing Mine area (fig. 1), which is about 4 km north of the Ash Meadows ACEC. Papke (1970) called this property the K-B deposit and described the clay as 4 feet (1.2 m) of white clay, overlain by 2.5 feet (0.8 m) of very pale orange impure clay, capped by as much as 8 feet (2.4 m) of vuggy limestone (fig. 9). According to Papke, the white clay has moderate swelling ability and low viscosity, whereas the overlying clay has lower swelling capacity and higher viscosity. Although Papke (1970) reported that the clay in this area contains abundant gypsum, a sample of the white clay taken for this study (AP-108) was found to consist of nearly pure Ca bentonite on the basis of XRD and chemical analysis (sample AP-108; Ludington and others, 2005).

Zeolite Deposits

Nearly pure deposits of the zeolite mineral clinoptilolite occur in the southwestern part of the Ash Meadows ACEC. Pale-yellow to white clinoptilolite occurs in a large deposit

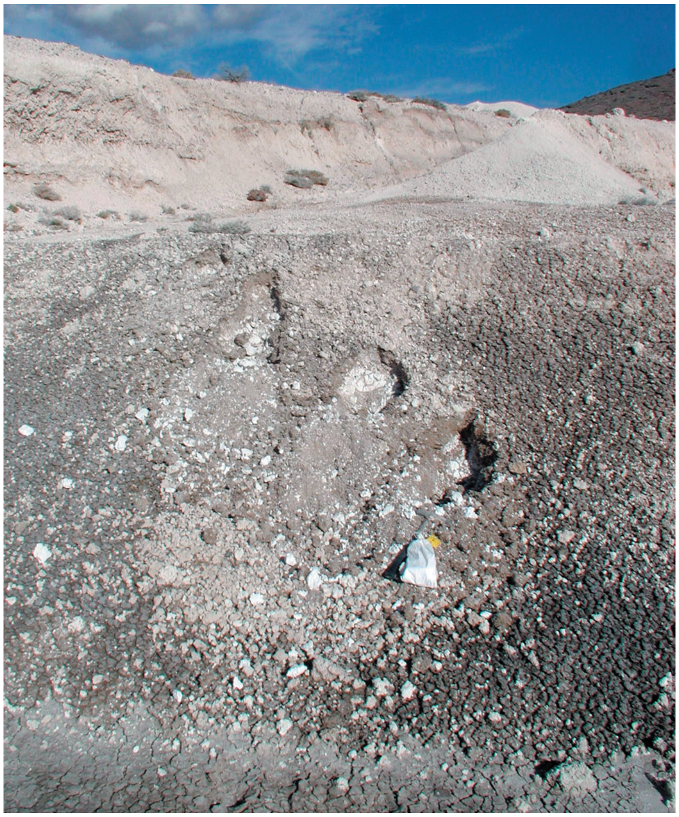


Figure 8. Site of sample AP-031 in the East Kinney Pit, a channel sample representing about 1.2 m of the 2-m thick clay bed.

Figure 9. White Ca-bentonite bed at least 1 m thick in the bottom of a pit wall in the Ewing Mine.

Figure 10. White clinoptilolite in an active pit in California south of the Ash Meadows ACEC. Pit walls are 15–30 m high.

Figure 11. Pale-green zeolitized tuff exposure in the Ash Meadows ACEC. Sample AP-081 was taken from the relatively resistant outcrop in the left foreground. The Ash Meadows Zeolite LLC processing plant is in the right background.

about 3 km south of the ACEC in California, where it is mined (fig. 10). The deposit reportedly extends into Nevada (Santini and Shapiro, 1982), where green clinoptilolite was mined in the past (fig. 11). The zeolite occurs in rocks that were mapped as a unit of Miocene or Pliocene sandstone and claystone (Denny and Drewes, 1965). According to Sheppard (1986), the clinoptilolite occurs in vitric, nonwelded, ash-flow tuff that dips 15°-30° eastward and ranges from 46 to 122 m thick. On the basis of XRD analysis, zeolitized tuffs from both the California mine site and exposures in Nevada are mineralogically identical and remarkably pure. The zeolitized rock is almost wholly composed of clinoptilolite (figs. 12 and 13), verifying Sheppard s report that the rock contains more than 80 percent clinoptilolite. Impurities are smectite clay, opal, and crystal and lithic fragments (Sheppard, 1986). Chemical analysis indicates that the green zeolite from Nevada (AP-081) is nearly identical in silica content to the California zeolite (AP-078), but has slightly higher amounts of potassium and lower amounts of sodium and calcium (table 1; Ludington and others, 2005). The zeolitized rock from both localities has considerably lower silica than nonzeolitized tuff collected nearby (AP-104G).

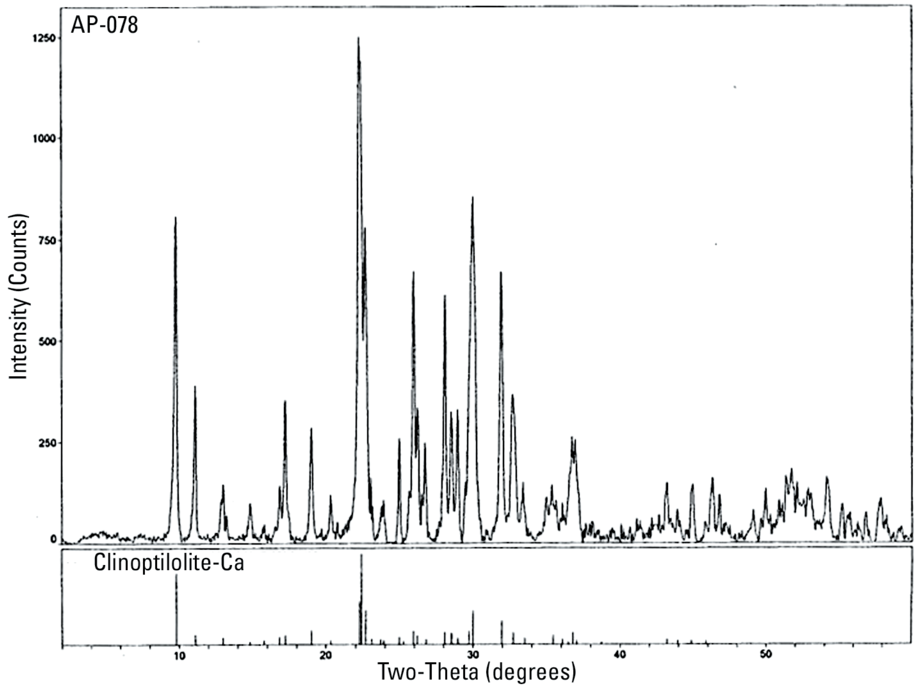


Figure 12. XRD analysis of sample AP-078, zeolite ore from Ash Meadows Zeolite pit in California.

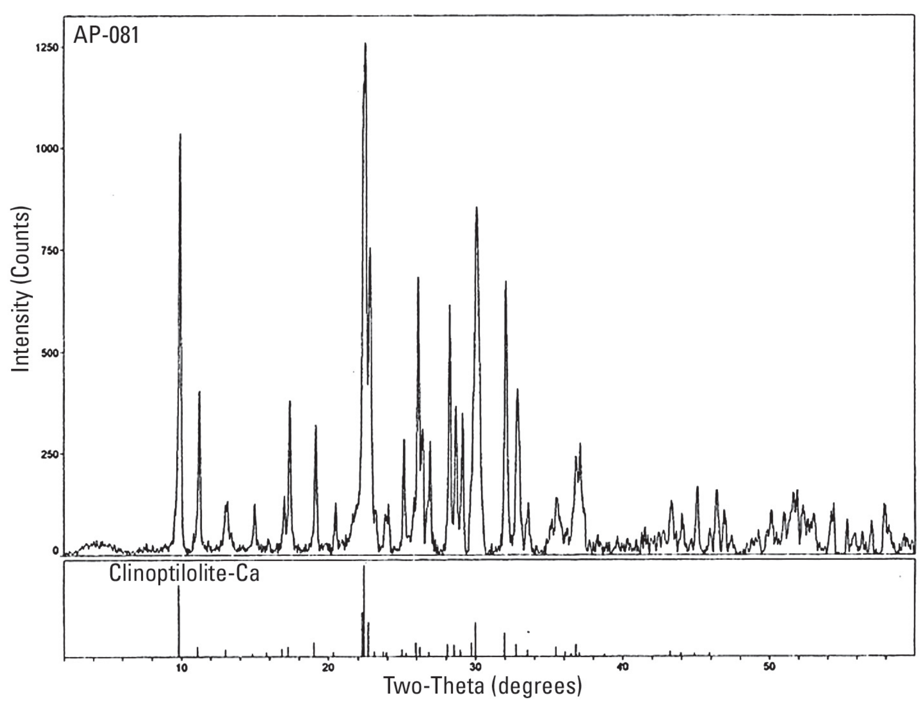


Figure 13. XRD analysis of sample AP-081, zeolitized tuff from Nevada.

Table 1. Comparison of chemical analyses of zeolite ore from the Ash Meadows Zeolite (AMZ) mine in California and a prospect in Nevada with unaltered tuff.

Sample------------	**AP 078**	**AP 081**	**AP 104G**
Location-----------	**Ash Meadows Zeolite mine, CA**	**Ash Meadows Zeolite prospect, NV**	**SW of AMZ claims, NV**
Description-------	**White zeolitized tuff**	**Green zeolitized tuff**	**White glass shard tuff**
SiO_2 (wt. %)	65.59	66.36	71.34
Al_2O_3 (wt. %)	10.96	10.82	10.76
Fe_2O_3 (wt. %)	0.79	0.68	0.85
MgO (wt. %)	0.24	0.16	0.30
CaO (wt. %)	1.41	0.99	1.27
Na_2O (wt. %)	3.96	2.79	3.73
K_2O (wt. %)	3.73	5.64	3.31
TiO_2 (wt. %)	0.09	0.09	0.09
P_2O_5 (wt. %)	0.01	0.02	0.02
MnO (wt. %)	0.04	0.01	0.03
Loss on ignition	13.1	12.3	8.3
Sum	99.92	99.86	100.00

Mineral Exploration and Development

The Ash Meadows and Amargosa Mesquite Trees ACECs have been the site of significant exploration drilling in the past. An extensive shallow drilling program was undertaken in the 1990s by Rio Tinto PLC in the area of sepiolite and saponite mining in the northeast part of the Ash Meadows ACEC and in the west part of the Amargosa Mesquite Trees ACEC. On the basis of this drilling, a large area of claims was staked in the Amargosa Flat area, including claims in the Ash Meadows and Amargosa Mesquite Trees ACEC.

Anaconda Minerals Co. drilled for zeolite in the southeast part of the Ash Meadows ACEC in the 1970s. On the basis of data acquired during this drilling, a block of claims was staked in the ACEC and in an adjacent area in Nevada and California.

We found many small pits and prospects in the Ash Meadows ACEC. Most of these were probably dug during clay exploration; however, they are generally poorly preserved shallow excavations that do not contain good exposures of clay-bearing strata. A few small prospects, probably exploring for zeolite, are in the south part of the Ash Meadows ACEC.

There are 60 active mining claims in or near the Ash Meadows and Amargosa Mesquite Trees ACECs. The largest claim block is the 31-claim “GA” group of Ash Meadows Zeolite LLC in the southwestern part of the Ash Meadows ACEC. These claims, with 2005 as the last assessment year of record, are southwest of the company’s Ash Meadows Ranch processing plant and extend in a southwesterly direction to the California border. Mud Camp Mining LLC holds five “CAT” claims in the Ash Meadows ACEC, three claims that are about 1 mile (1.5 km) south of the Kinney mine clay pits in Sec. 26, T. 17 S., R. 50 E., and two claims in the northeast part of ACEC the near its clay mines. In addition, the company holds 10 CAT claims in the west part of the Amargosa Mesquite Trees ACEC near its clay mines. A 12-claim block of “BOB” claims is held by individual locators near the south edge of the Ash Meadows ACEC. Individuals hold two claims, the Tyco and Broken Pick Mine claims in the northeast part of the Amargosa Mesquite Trees ACEC. This site includes a water well and a sign proclaiming the presence of the Buck Mining Company.

Mineral Resource Potential

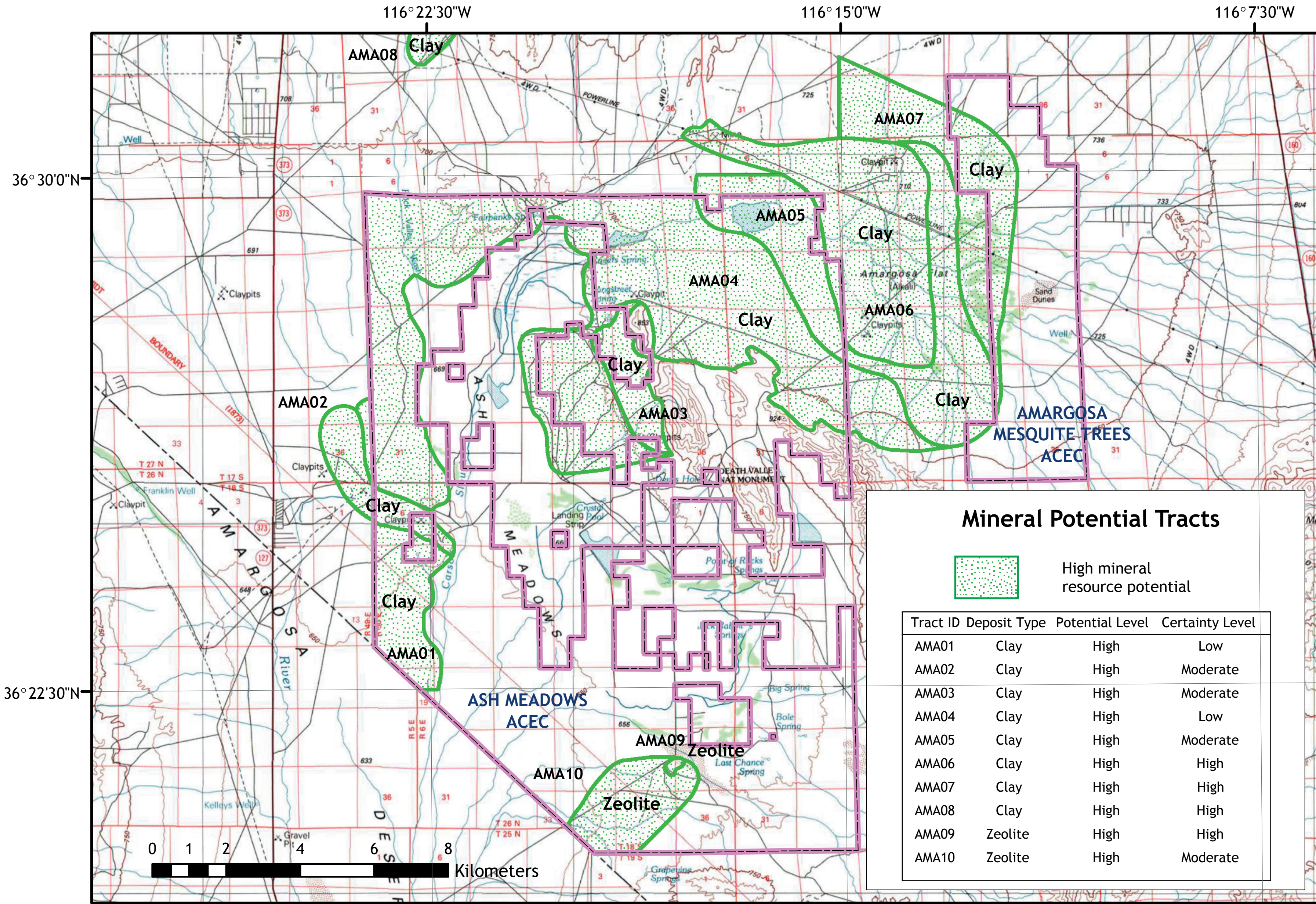
Locatable Minerals in Ash Meadows ACEC

Metals.— There is no evidence for metallic mineral resource potential in the Ash Meadows ACEC.

Clay.— Areas with high potential for clay deposits with a high level of certainty (tracts AMA06 and AMA08, fig. 14) contain active IMV Nevada clay mines, are directly adjacent to the mines, or are currently held under claim by IMV Nevada. For the most part, these areas are outside the ACECs, but tract AMA06 covers a small part of the Ash Meadows ACEC along its northwest boundary.

Areas with high potential for clay deposits with a moderate certainty level (tracts AMA02, AMA03, and AMA05, fig. 14) contain inactive clay mines that yielded samples with high clay contents. All these tracts cover part of the Ash Meadows ACEC and include areas near the Clay Camp pits and the Kinney Mine (fig. 1).

Areas with high potential for clay deposits with a low certainty level (tracts AMA01, AMA04, and AMA07, fig. 14) are defined by scattered occurrences of clay noted in Hay and others (1986) and (or) by favorable strata of probable Pliocene age. Tracts AMA01 and AMA04 cover large parts of the Ash Meadows ACEC.



Tract ID	Deposit Type	Potential Level	Certainty Level
AMA01	Clay	High	Low
AMA02	Clay	High	Moderate
AMA03	Clay	High	Moderate
AMA04	Clay	High	Low
AMA05	Clay	High	Moderate
AMA06	Clay	High	High
AMA07	Clay	High	High
AMA08	Clay	High	High
AMA09	Zeolite	High	High
AMA10	Zeolite	High	Moderate

Figure 14. Mineral resource potential tracts for locatable and leasable minerals in the Amargosa Mesquite Trees and Ash Meadows Areas of Critical Environmental Concern (ACEC).

Zeolite.— In the southern part of the Ash Meadows ACEC, two areas are considered to have high potential for zeolite deposits (fig. 14). Tract AMA09 is a small area with high potential with a high certainty level, and is defined by exposures of strongly zeolitized tuff that are currently under claim by Ash Meadows Zeolite LLC. The larger tract AMA10 has high potential with a moderate certainty level, and is covered by overburden; it is currently under claim by Ash Meadows LLC.

Leasable Minerals in Ash Meadows ACEC

The southwestern half of the Ash Meadows ACEC is within the region considered by the BLM to be moderately favorable for oil and gas (Smith and Gere, 1983). The northeastern half, and the entire Amargosa Mesquite Trees ACEC, are not within this region.

There is no indication of potential for brine or evaporite deposits of sodium or potassium.

The Ash Meadows ACEC contains no known deposits of other leasable minerals, and the potential for their occurrence is judged to be low.

Salable Minerals in Ash Meadows ACEC

Crushed Stone.— A few areas underlain by Cambrian carbonate rocks in the eastern part of the ACEC (tract AAMA03, fig. 15) are designated to have moderate potential for crushed-stone aggregate, with a low level of certainty. The northernmost exposures of bedrock are mapped as Nopah Formation. The low chert content within this unit means that this area (tract AAMA01, fig. 15) has high potential, with a low level of certainty. In the southern part of the area, outcrops of the younger sediments and volcanic rocks (tract AAMA02, fig. 15) are soft and friable and unsuitable for crushed stone and are designated to have low potential, with a moderate certainty level.

Sand and Gravel.— A large part of the Ash Meadows ACEC has low potential for sand and gravel aggregate, with a moderate level of certainty (tract AAMA07, fig. 15); the materials exposed are primarily soft and fine-grained sedimentary material. High-potential sand and gravel deposits with a moderate certainty level occur adjacent to carbonate outcrops in the Devils Hole area and around the southern and western parts of the area (tract AAMA05, fig. 15).

Locatable Minerals in Amargosa Mesquite Trees ACEC

Metals.— There is no evidence for metallic mineral resource potential in the Amargosa Mesquite Trees ACEC.

Clay.— Areas with high potential for clay deposits with a moderate level of certainty (tracts AMA02, AMA03, and AMA05; fig. 15) contain inactive clay mines that yielded samples with high clay contents. Only tract AMA05 impinges on the Amargosa Mesquite Trees ACEC, including small areas along its western boundary.

Areas with high potential for clay deposits with a low certainty level (tracts AMA01, AMA04, and AMA07, fig. 15) are areas defined by scattered occurrences of clay noted in Hay and others (1986) and (or) by favorable strata of probable Pliocene age. Tract AMA07 includes a substantial part of the northwestern part of the Amargosa Mesquite Trees ACEC.

Leasable Minerals in Amargosa Mesquite Trees ACEC

The entire Amargosa Mesquite Trees ACEC is outside the region considered by the BLM to be moderately favorable for oil and gas (Smith and Gere, 1983).

There is no indication of potential for brine or evaporite deposits of sodium or potassium.

The Amargosa Mesquite Trees ACEC contains no known deposits of other leasable minerals, and the potential for their occurrence is judged to be low.

Salable Minerals in Amargosa Mesquite Trees ACEC

Crushed Stone – There are no rock outcrops, and thus there is no potential for crushed-stone aggregate in the Amargosa Mesquite Trees ACEC.

Sand and Gravel - The northern part of the Amargosa Mesquite Trees ACEC has low potential for sand and gravel aggregate, with a high level of certainty (tract AAMA06, fig. 15). This area consists of soft and fine-grained sedimentary material. In the southern part of the area quartzite and carbonate clasts derived from the highlands to the southeast indicate an area with high potential for sand and gravel aggregate, with a low certainty level (tract AAMA04, fig. 15).

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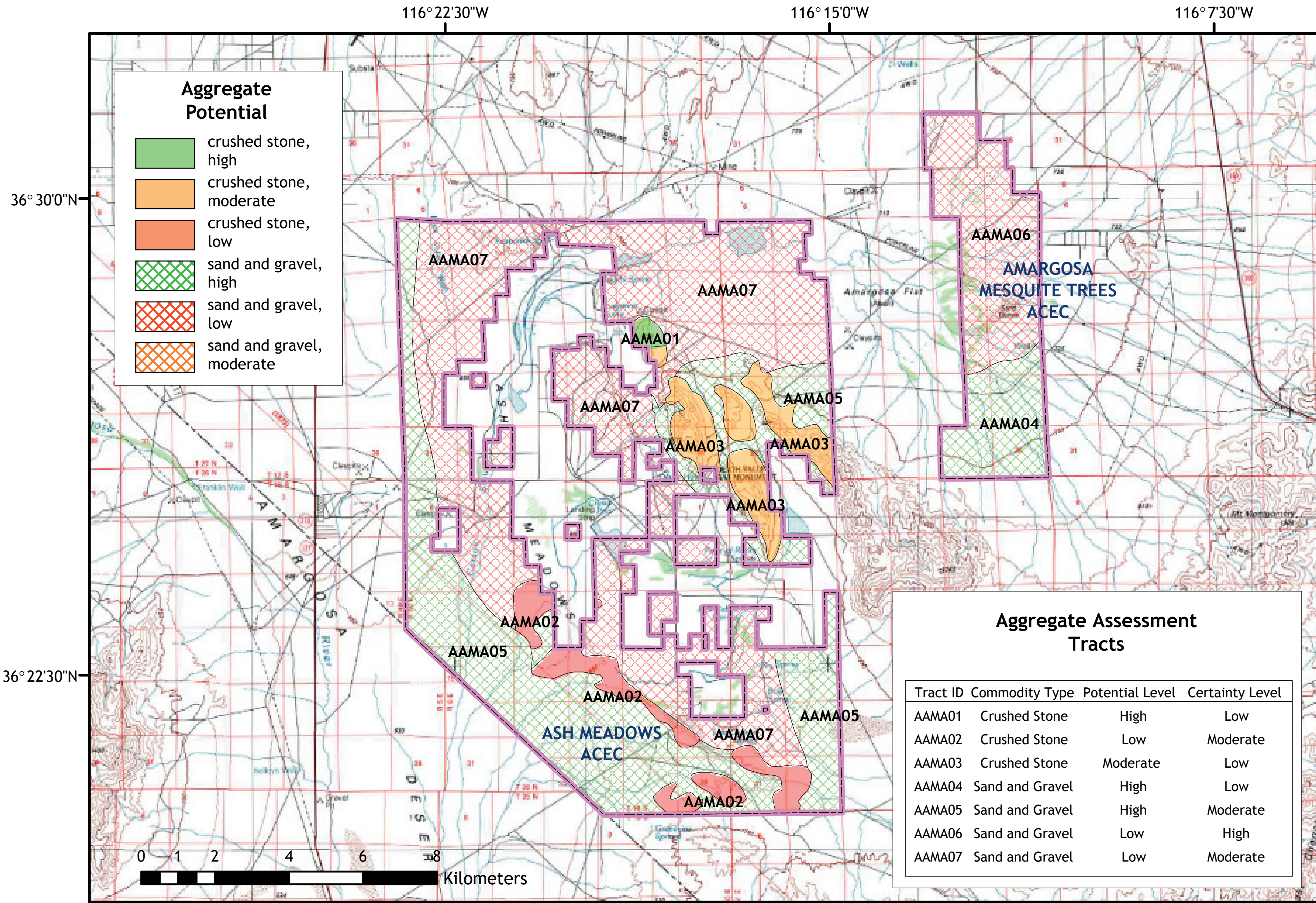

Tract ID	Commodity Type	Potential Level	Certainty Level
AAMA01	Crushed Stone	High	Low
AAMA02	Crushed Stone	Low	Moderate
AAMA03	Crushed Stone	Moderate	Low
AAMA04	Sand and Gravel	High	Low
AAMA05	Sand and Gravel	High	Moderate
AAMA06	Sand and Gravel	Low	High
AAMA07	Sand and Gravel	Low	Moderate

Figure 15. Mineral resource potential tracts for aggregate resources in the Amargosa Mesquite Trees and Ash Meadows Areas of Critical Environmental Concern (ACEC).

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