Chapter BI

BIOSTRATIGRAPHIC FRAMEWORK

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BIOSTRATIGRAPHIC INTERPRETATIONS

General Framework

The biostratigraphic framework used in this report is derived from publicy available reports prepared by two private consultant companies: Micropaleo Consultants, Inc. (formerly known as BioStratigraphics) and the Bujak Davies Group. These two competing companies analyzed different groups of microfossils for their interpretations. Micropaleo Consultants used benthic foraminifera and palynomorphs (1983, 1984, 1988, 1989, 1991, 1992, 1993a, b, c); Bujak Davies used only palynomorphs (1985; see also Paul, 1994) . The companies reached quite divergent interpretations of several wells, including the East Mikkelsen Bay State-1, West Staines -1, Alaska State A-1, and Aurora (Plates BI1, BI2). The differences are most pronounced in the Aurora well, in which Micropaleo Consultants (1988) recognized 11,260 ft of Eocene or probable Eocene section (Plate BI1-A), whereas the Bujak Davies Group recognized only about a third as much Eocene (4,810 ft; Plate BI1-B). Similar differences can be seen in the interpretations of Cenozoic strata in the other three wells analyzed by both groups. In particular, the Bujak Davies Group defined upper and lower Oligocene sections, whereas Micropaleo Consultants did not clearly separate the Oligocene from the Miocene. Furthermore, in the East Mikkelsen Bay State-1 well, there is a 4,100 ft difference in the placement of the Cretaceous-Tertiary contact. Micropaleo Consultants placed it at 12,400 (Plate BI1-A); Bujak Davies placed it at 8,300 ft (Plate BI1-B).

For this report, I use a composite biostratigraphy (Plate BI2). I apply the interpretations of the Bujak Davies Group where available (East Mikkelsen Bay State-1, West Staines-1, Alaska State A-1, Aurora), in part, because they subdivided the Cenozoic section more completely than did Micropaleo Consultants. The other wells are correlated using Micropaleo Consultants' data, but I arbitrarily divided some of their undivided sections into approximately equal parts (Plate BI2).

In the Belcher well, Micropaleo Consultants placed the Eocene/Paleocene boundary somewhere within the interval 7900-10,640 ft. I have further constrained the boundary interval to 7900-8780 ft based on the consistent occurrences of the pollen taxon *Paraalnipollenites confusus* below 8780 ft (Norman O. Frederiksen, written comm., 1997).

Problems of Interpretion

Drastic divergences in the placement of stratigraphic boundaries, especially notable in the Aurora well (Plate BI1), arise from a variety of correlation problems, due to both natural and drilling-related causes. A primary drilling-related problem is the necessity of using mainly rotary ditch samples. Such samples are composites, representing 10-30-ft intervals (or more), and are subject to extensive contamination from downhole caving. *In situ* core samples are sparse and widely spaced in most wells.

Another drilling-related problem is the occasional use of lignitic drilling mud, which contains palynomorphs abundant enough to mask the *in situ* flora. Paul (1994) cites this as a problem in the Aurora well. Even sidewall cores are subject to contamination from drilling mud that may contain its own palynoflora, or may entrain microfossils from other parts of the well bore (e.g., Micropaleo Consultants, 1988).

A notable natural problem encountered in nearly all the cited wells is the presence of large numbers of specimens interpreted to be reworked from older strata. For example, Mesozoic foraminifera are abundant in the Miocene, Oligocene, and early Paleocene sections of the Aurora well (Plate BI2). In the Wild Weasel and Kuvlum -2 wells, abundant Eocene dynocysts are present in the early Oligocene section. The latter occurrences are particularly difficult to interpret, because the "reworked" specimens are very close in age to the section into which they were reworked. The dilemma in these examples is whether the Eocene taxa have been reworked into the Oligocene section, or the Oligocene taxa have fallen down the bore hole into the Eocene section. Furthermore, if no cores are available for such a section (as is the case in several of the wells studied), it is nearly impossible to determine whether any of the microfossils are actually in place. Paul (1994) and the Bujak Davies Group (1985) discuss these problems more thoroughly and cite specific well examples.

Another fundamental natural problem is the difficulty of correlating high-latitude microfossil assemblages with their low-latitude counterparts, which generally are used as standard references. For example, the dominantly agglutinated benthic foraminiferal assemblages characteristic of so much of the Alaskan section, are extremely difficult to correlate with standard biostratigraphic sections developed in low latitudes using planktonic calcareous taxa. Marine dinocyst zonations also were originally developed

from low-latitude sections, and are difficult to apply in high latitudes. Moreover, because the biogeographic distribution of the parent plants of spore and pollen taxa are controlled by paleoclimate, the stratigraphic ranges of these taxa also vary between different paleolatitudes.

In short, because of the myriad natural and drilling-related correlation problems inherent to the wells cited herein, the biostratigraphic framework must be considered tentative; it may be subject to considerable revision as new data become available.

PALEOENVIRONMENTAL INTERPRETATIONS

Paleoenvironmental interpretations given in this report (Plate BI2) are derived entirely from the reports of Micropaleo Consultants, Inc. The interpretations are based principally on the presence (or absence) and relative abundance of benthic foraminiferal species, and upon the ratio of marine microfossils (benthic foraminifera, dinoflagellates, mollusk fragments, fish skeletal debris, marine diatoms, marine ostracods, sponge spicules) to nonmarine taxa (spores, pollen, nonmarine ostracods). The Bujak Davies Group (1985), which relied entirely on palynology, provided broad paleoenvironmental interpretations based mainly on the presence-absence of marine taxa and on kerogen type. Their interpretations generally agree with those of Micropaleo Consultants.

Paleoenvironmental terminology used on Plate BI2 is very broadly defined by Micropaleo Consultants, Inc; the terms are relative, not strictly equated to specific water depths. Neritic means essentially continental-shelf or deltaic environments; bathyal means continental-slope, prodelta, or starved basin (far from sediment source) environments. In many sections, only gross approximations of paleodepth are given. A notable example is the middle to early Miocene section of the Galahad well, in which the paleodepth estimate is inner neritic to bathyal.

Mesozoic sections accumulated in deeper water than Cenozoic sections throughout the study area, except for the Aurora well. In Cenozoic strata, Paleocene and Eocene sections tend to be deeper-water deposits than Oligocene-Pliocene sections at onshore locations (Canning River and West Staines wells). At the easternmost offshore locations (Aurora, Belcher), however, Oligocene and Miocene paleodepths equaled or exceeded most of the Eocene and Paleocene paleodepths.

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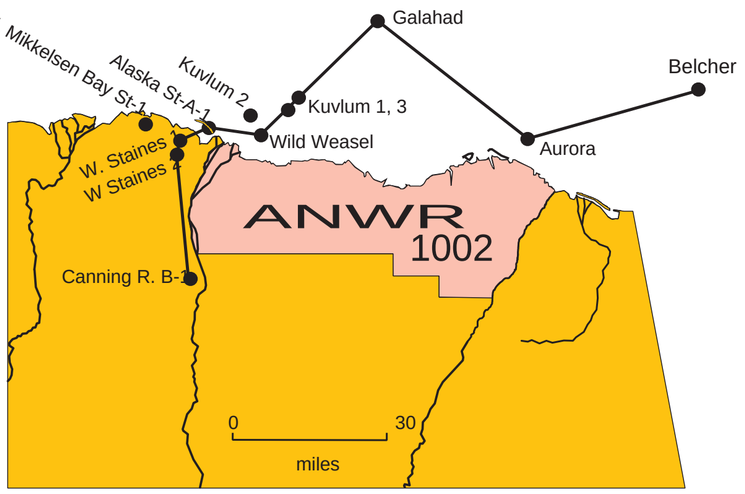
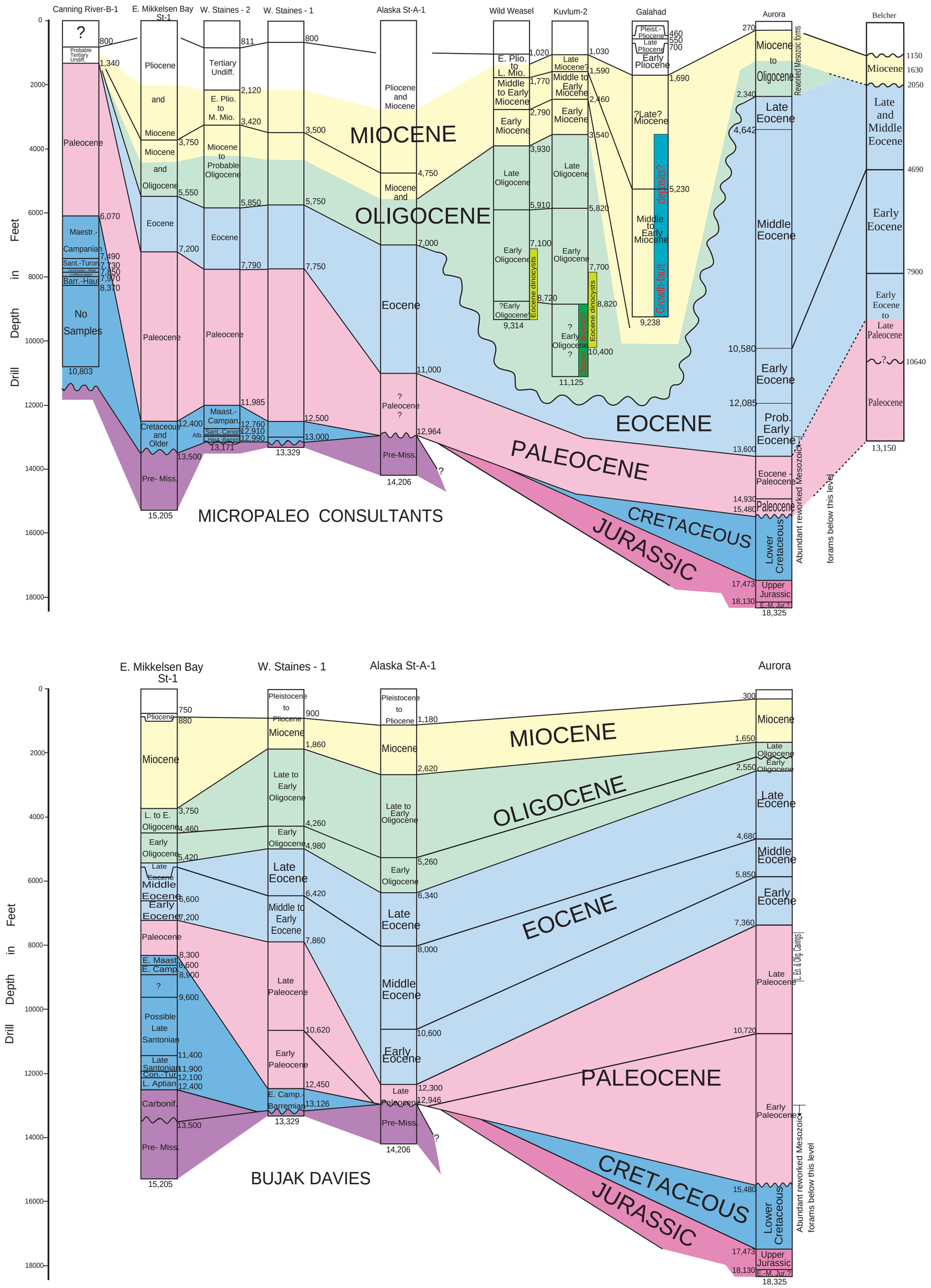
A





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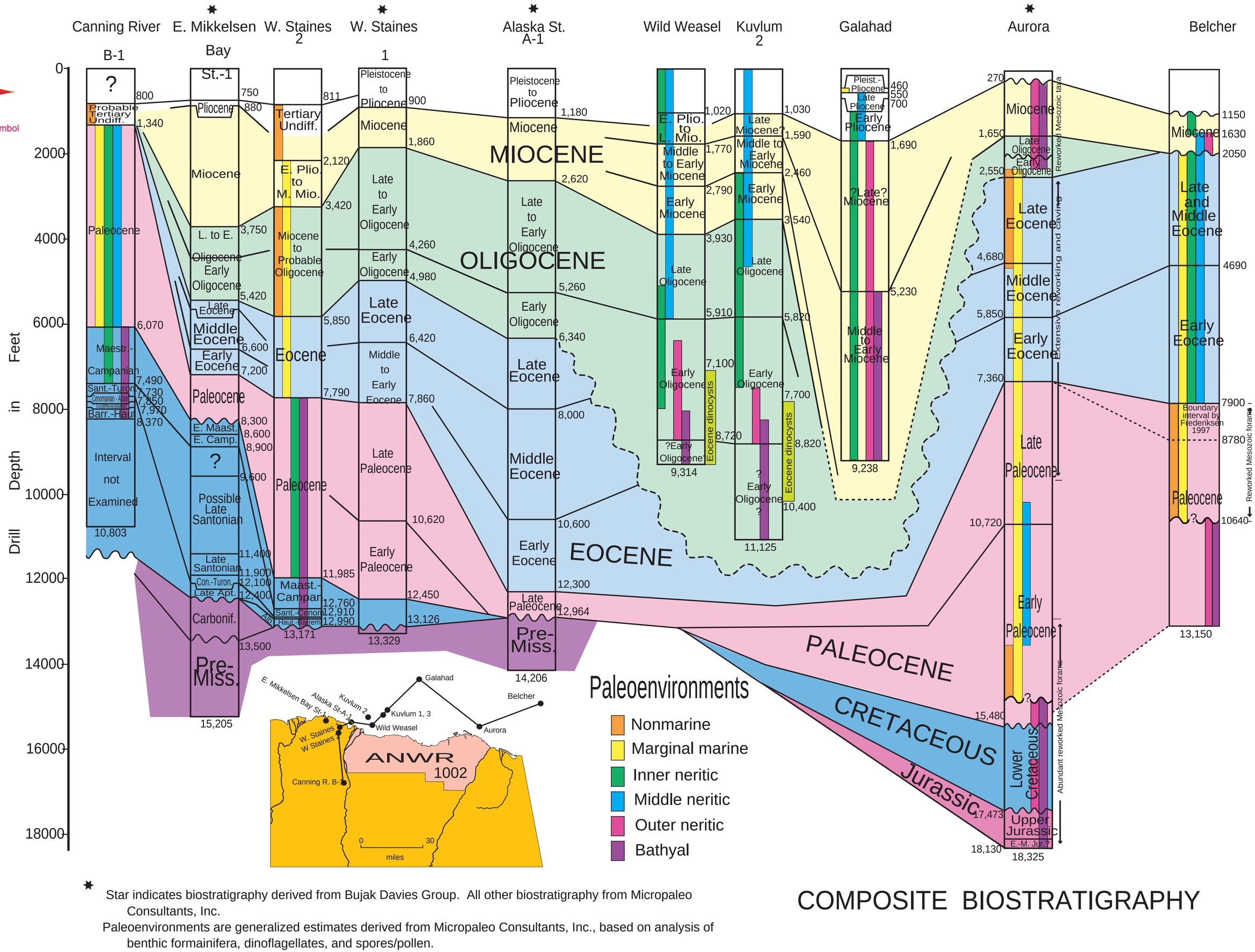

★ Star indicates biostratigraphy derived from Bujak Davies Group. All other biostratigraphy from Micropaleo Consultants, Inc.

Paleoenvironments are generalized estimates derived from Micropaleo Consultants, Inc., based on analysis of benthic formainifera, dinoflagellates, and spores/pollen.

COMPOSITE BIOSTRATIGRAPHY