relatively high above background uranium-thorium concentration (11 versus 3 ppm U; 26 versus 8 ppm Th). Previously this zone marked the upper boundary of the pebble shale, however, two horizons are recognizable within the gamma zone, the lower one containing rounded quartz grains and hence pebble shale and the upper one devoid of floating quartz grains.

Clay mineralogy, organic geochemistry, micropaleontology, and sedimentary structures from core and cuttings indicates a stratigraphic sequence through the Neocomian of upper to lower slope facies followed by inner and outer shelf facies and finally deposition of euxunic sediments. The pebbly mudstone facies, derived from a northerly source, is interpreted as a lowstand and subaqueous delta environment formed as the northern provenance was uplifted during Valanginian time. Rapid subsidence of this basin margin was related to the inferred Atlantic margin type downfaulting north of the Barrow arch. The subsequent deposits produced a blanket of sediment 300,000 mi^2 (482,700 km^2) in areal extent. Thin (2 to 9 ft, 0.8 m), fine-grained sands occur within the pebble shale of the Barremian silty shale facies and are restricted to the Barrow area. These sands have an average combined thickness of 45 ft (15 m) and contain traces of oil. Paleogeographic considerations imply better reservoir and coalescing of these sands to the north toward the paleoshoreline and suggest potential for discovery of hydrocarbon reserves from drilling locations on the northern barrier island systems and offshore.

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Radiolarian Biostratigraphy of Hawasina Complex, Northern Oman

The allochthonous Hawasina complex is a sedimentary sequence of both continental-slope and oceanic-basin deposits that were thrust up over shallow-water marine carbonates of the Arabian Shelf during the Late Cretaceous. The Hawasina tectonically overlies the autochthonous Hajar Super Group, and is overlain tectonically by the Samail Ophiolite and associated sedimentary rocks.

The lower thrust units, the Hamat Duru Group, and Wahrah Al Ayn Formations, are generally interpreted as limestone and sandstone turbidites deposited on the continental rise. The Wahrah Formation and lower Zulla and upper Sid'r Formations within the Hamrat Duru Group all contain thick sequences of radiolarian-bearing chert. Samples collected from the Zulla and Wahrah (lower chert member) Formations yielded radiolarian faunas assignable to the Late Triassic (Karnian/Norian) based on key species of the genera *Capnodoce*, *Capnuchosphaera*, *Eptingium*, *Sarla*, *Triassocampe*, and *Yeharaia*. Additional samples from the Zulla Formation indicate an Early Jurassic (Pliensbachian) age based on the presence of *Broctus*, *Canoptum*, *Canutus*, *Droltus*, and *Pseudoheliodiscus* sp.; previous investigators suggested a hiatus in pelagic sedimentation during Early Jurassic time. Radiolarian faunas extracted from two measured sections of the Wahrah Formation (upper chert member) range in age from the Late Jurassic (Tithonian) to Early Cretaceous (late Valanginian/Hauterivian). No suitable radiolarian faunas were obtained from cherts of the Sid'r Formation (Hamrat Duru Group).

The higher thrust units are represented by the conglomeratic Al Ayn Formation, and the deeper water Halfa and Haliw Formations. Radiolarian faunas extracted from a measured section near the type locality of the Halfa Formation range in age from the Late Jurassic (Kimmeridgian/Tithonian) to the Early Cretaceous (Hauterivian/Barremian). All the radiolarian faunas obtained thus far from the Haliw Formation are assignable to the Late Triassic (late Karnian to middle Norian) based on fragments of *Capnodoce* and *Veghicyclia* sp.

Previous biostratigraphic data suggested that the thickest sections of radiolarian chert and mudstone were deposited during Late Jurassic and Early Cretaceous time. Newly obtained paleontologic evidence based on radiolarian biostratigraphy indicates that significant pelagic sedimentation occurred also during the Late Triassic and Early Jurassic.

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Reevaluation of Early Tertiary Radiolarian Faunas from Kellogg and Sidney Shales of Mount Diablo Area, California

B. L. Clark and A. S. Campbell in 1942 published a pioneering biostratigraphic report on the radiolarian fauna from two shale units in the Mt. Diablo area. These shales, called by some authors the Sidney or Sidney Flat Shale and the Kellogg Shale, are about 11 mi apart and were considered to be two different units of the upper Eocene series. They noted that 63% of the Kellogg species are not present in the Sidney Flat and about 58% of the Sidney species are not present in the Kellogg. Sidney Flat was considered younger than the Kellogg by field evidence. Clark and Campbell's paper represented one of the first attempts to use radiolarians as a stratigraphic tool on land geology. The authors described many new species based on few and subtle differences in characters, but with little knowledge of radiolarian morphological variation. Reevaluation of their taxonomy reveals that many characters are now considered nondiagnostic at the species level and that many of their species are synonymous. This result reduces the apparent biostratigraphic difference between the Kellogg and Sidney Flat Shales. Diatom, bethic, and planktonic foraminifers and silicoflagellates have shown that the Sidney Flat and Kellogg are very similar. The foraminifer data indicate that they are the same biostratigraphic unit. Diatoms suggest that the Sidney may be slightly younger. This study (1) reevaluates Clark and Campbell's radiolarian taxonomy, (2) reevaluates their stratigraphic and environmental significance, and (3) illustrates the importance of using characters that reflect evolutionary change in biostratigraphy.

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Distribution of Spongodiscid-Type Radiolarians In Modern Sediments

Spongodiscid-type radiolarians have a spongy appearance (foamy or loosely organized skeleton), are discoidal in shape and may or may not have flat extensions (arms) from the central region of the skeleton. They are common in modern sediments, are cosmopolitan in distribution, and range throughout the Phanerozoic. Their significance in modern sediments has not been fully investigated, especially with respect to their ecology.

Morphologic characteristics are investigated in this study, especially the type of matrix, spines, outer covering, and internal growth, and how it relates to environmental parameters. Spongodiscid-type distributions in the present oceans are evaluated (1) by using published reports on spongodiscid-types in modern sediments and (2) by observing samples material (SEM