

ic waters percolating basinward from Tensleep outcrop areas also had the effect of forming a "tar seal" in the oil-water transition zone; this seal effected a "frozen" oil-water contact, further preventing re-adjustment of paleoaccumulations into crestal positions in the Laramide closures.

Anticlines on which production has been established in the Phosphoria, Tensleep, and older Paleozoic reservoirs, exhibit a common oil-water contact datum for each of the producing formations. Extensive vertical fracturing, allowing commingling of reservoir fluids, is a possible mechanism which would allow oil originating in the Phosphoria to accumulate in underlying formations and account for the common oil-water contact conditions.

Subsurface data presently available indicate a loss of porosity with increased depth in the Tensleep Sandstone. It is suggested that possibilities for locating adequate porosity at greater depths will be enhanced by exploration in those areas favorable to the accumulation of oil in primary traps which have not been modified greatly by Laramide folding.

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FABRIC OF A MIDDLE ORDOVICIAN LIMESTONE AT COLBORNE, ONTARIO

The limestone of the Middle Ordovician Cobourg Limestone at Colborne, Ontario, occurs, in decreasing order of occurrence, as sparse biomicrite, fossiliferous micrite, biosparite, micrite, and packed biomicrite.

Individual beds display a sequence composed of graded bedding at the base, overlain by a zone of lamination, and structureless micrite. This resembles the sequence in terrigenous turbidites of the Alps and other places. Most disarticulated brachiopod and ostracod shells are convex upward in biosparite and convex downward in biomicrite and fossiliferous micrite. The percentage of brachiopod shells increases toward the bottom of the quarry; a variation in the percentage across the quarry has been found. The percentages of echinoderm, bryozoan, and ostracod fragments have a high positive correlation with the quantity of quartz grains, whereas the percentages of brachiopod shells and trilobite fragments do not. Orientation patterns of elongate fossils show two dominant trends, northeast-southwest and northwest-southeast.

Sedimentation of the Cobourg Limestone was characterized by weak currents. Strong currents were introduced sporadically to form graded and non-graded biosparites, which are suggested tentatively as products of turbidity currents.

All relations between geological entities were calculated by computer.

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Patagium AND SOME SPUMELLARIAN (RADIOLARIA) GENERA

Patagium is a unique structure found in some spumellarian Radiolaria and has been considered to be a diagnostic criterion at the generic level in the generally accepted scheme of classification. A continuous variation in degree of preservation and (or) developmental stages of this structure from complete to absent has been found in genera such as *Hymeniastrum-Dictyastrum* and *Euchitonina-Rhoparastrum* from northeast Pacific Ocean bottom sediments. The study of a rich radiolarian fauna in core samples from Java,

Mindanao, and Mariana trenches reveals similar features and indicates that such a complete sequence of variation is neither a rare phenomenon nor biogeographically significant.

The taxonomic value of *Patagium*, therefore, needs critical reconsideration. The degree of development or preservation of *Patagium* found in a specimen seems to be unrelated to radiolarian ontogeny, although its real significance can not now be determined.

Fragments of the diatom *Ethmodiscus rex* (Wallich) Hendey also are found abundantly and consistently in the middle and lower parts of the Mindanao trench subsurface section, whereas only a few sporadic occurrences are found in the Java and Mariana trench samples.

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PLANKTONIC FORAMINIFERAL ZONATION OF CALIFORNIA "MIOCENE"

Planktonic Foraminifera occur abundantly in most California "Miocene" strata, but have not been studied previously in detail. By using these planktonic forms, 11 zones are recognized and are related to the existing "Miocene" stages which are based on benthonic species. Correlation of these zones with the standard reference sections of tropical regions is complicated by paleoecologic factors, which probably include regional variation in water temperature between the tropics and California. Stratigraphically lower zones correspond more closely than do higher ones, indicating a general cooling of the California seas throughout middle Cenozoic time.

Species of *Globigerina* and *Eoglobigerina* are abundant in the California "Miocene," whereas species of *Turborotalia*, *Globoquadrina*, *Globigerinoides*, *Globorotaloides*, *Protentella*, and *Candorbulina* are less common but provide bases for tentative correlation with the tropical zones. The "lower Miocene" Zemorrian and Saucasian stages are correlated with the *Globigerina sellii* through *Turborotalia kugleri* zones (Oligocene to Aquitanian); the "middle Miocene" Relizian and Lusian stages correlate with the *Catapsydrax dissimilis* through *Turborotalia johsi* zones (Aquitanian to Burdigalian); and the "upper Miocene" Mohnian and Delmontian stages correlate with the *Globorotalia lobata* through *Sphaeroidimella seminula* zones (Burdigalian to Sarmatian).

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OSTRACODES AND SILURO-DEVONIAN BOUNDARY IN SOUTH-CENTRAL OKLAHOMA

Detailed studies of the morphology, ontogeny, variation, and stratigraphic distribution of the ostracodes in the Henryhouse (Silurian) and superjacent Haragan (Devonian) Shales indicate the presence of an unconformity at the Siluro-Devonian boundary in the Arbuckle Mountains of Oklahoma. The ostracodes indicate a late Niagaran (early Ludlovian) age for the Henryhouse Shale and Helderbergian age for the Haragan Shale.

The ostracode faunas of both stratigraphic units are large and diversified. The Henryhouse Shale contains 46 species representing 28 genera and 17 families. The Haragan ostracode fauna consists of 53 species, 27 genera, and 16 families. These taxa are distinctive and readily identifiable.

Biostratigraphic evidence for the unconformity be-