same time, however, economic and political pressures have induced concern and there is now a much increased emphasis on jurisdiction to divide the offshore areas between the 132 coastal nations. Negotiations affect research operations at sea and, in consequence, marine scientists have been made aware of offshore problems as highlighted by the Law of the Sea Treaty (UNCLOS III) and complications arising from the legal versus scientific definitions of continental shelves and margins. Most scientists, however, are not familiar with juridical considerations in the delimitations of offshore state boundaries.

As to prevailing trends, many jurists contend that existing state practice and decisional law pertaining to maritime delimitation problems are presently adequate to provide a legal framework for negotiation and third-party adjudications. It also has been suggested that in delimiting maritime boundaries primacy must be accorded to geographic factors, and that support be given to the equidistance-proportionality method as a means of giving effect to geographic factors. But what about geology?

The first major offshore boundary case of international scope where plate tectonics has constituted a significant argument is the one recently brought before the International Court of Justice by Libya and Tunisia concerning the delimitation of their continental shelves. Of the two parties, Libya placed the greatest emphasis on this concept as a means to determine natural prolongation of its land territory into and under the sea. Tunisia contested Libya's use of the whole of the African continental landmass as a reference unit; in Tunisia's view, considerations of geography, geomorphology, and bathymetry are at least as relevant as are those of geology. In its landmark judgement (February 1982)—which almost certainly will have far-reaching consequences in future such boundary delimitation cases—the court pronounced that "It is the outcome, not the evolution in the long-distant past, which is of importance," and that it is the present-day configuration of the coasts and sea bed which are the main factors to be considered, not geology.

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Flexure of Anadarko Basin

The Anadarko basin in Oklahoma has long been a major oil and gas producing region and contains the deepest wells drilled in North America. The region has had a long sedimentary-tectonic history reaching back to the Proterozoic and was the site of an early Paleozoic basin. The present shape of the Anadarko basin, however, was developed in late Paleozoic times as a result of the uplift of the Wichita Mountains. COCORP seismic reflection profiles show at least 8 to 9 km (5 to 5.6 mi) of overthrusting northward, and the Anadarko basin was developed as a result of flexural bending of the lithosphere due to this shortening. Downwarping of the basin can be observed to extend for over 300 km (185 mi) northward, indicating a high flexural rigidity (Te > 40 km [25 mi]). However, nearer the Wichita front, the basin steepens rapidly as the post-Mississippian sediments thicken to over 20,000 ft (6,100 m). The shape of the bending is such that it cannot be explained by the use of a constant rigidity elastic plate model. We have modeled the post-Mississippian development of the Anadarko basin as the result of flexure of an elastic-plastic plate due to vertical and horizontal loading caused by the Wichita Mountains. Implications of these results for the development of the Anadarko basin and the mechanical properties of continental lithosphere will be discussed.

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Mid-Cenozoic Tectonic Timing, Trans-Pecos Texas

This work attempts to establish the age and chronologic sequence of mid-Cenozoic tectonic events in Trans-Pecos Texas through the use of radiometric dates, and new or revised structural, lithostratigraphic, and vertebrate biostratigraphic information. Late Mesozoic to early Cenozoic Laramide faulting, folding, and jointing superimposed on older trends, established the fabric governing younger structures. Late Oligocene events, occurring about 28 to 26 m.y.B.P., include right-lateral divergent wrench faulting, local compression, and the last episodes of silicic intrusion-extrusion. The major period of basin-and-range faulting began about 19 m.y.B.P., accompanied by late and mafic minor intrusion. This paper follows the sequence of tectonic events established by Muehlberger in 1980 and DeCamp in 1981 for Trans-Pecos Texas.

A widespread low relief surface was cut across Laramide structures as deformation decreased in the Eocene. Integrated, perennial streams flowing southeastward began extensive laterally continuous aggradation in the area south and southwest of the stable Diablo uplift. Mainly fine, volcaniclastic sediments accumulated on surfaces of continued low relief. Initially, sediment sources were distant but became progressively more local. Episodic ignimbrites and flows covered large areas with increasing frequency. Eocene climate in Trans-Pecos Texas was humid and subtropical, but an irregular trend toward increasing dryness was evident by 31 m.y.B.P.

Sedimentary bodies younger than middle Oligocene have little lateral continuity. Deposited under semiarid conditions, as destructional volcanic sediment aprons, alluvial fans, or bolson fills, these units show progressive divergence from depositional styles of early Tertiary sediments. Early Arikareean (early late Oligocene) right-lateral divergent wrench faulting interrupted long-established drainage patterns. The faulting, dated by intrusions and biostratigraphy at about 28 to 26 m.y.B.P., closed the interval of laterally continuous, and preceded that of discontinuous, deposition. The irregular Terlingua monocline, long considered a Laramide structure, is re-interpreted as another example of Trans-Pecos Texas linear east-west tectonic elements discussed by Dickerson in 1981. The structure is a large monocline cut by a set of en echelon-left normal faults and smaller monoclines, modified by compression. Formation of the large monocline involved rocks as young as late Eocene-early Oligocene. The Terlingua monocline provides clear evidence of the sequence of events and some indication of timing. Later Arikareean sediments lie on uneven eroded older rocks, disturbed by early stages of this wrench faulting. About 23 m.y.B.P. downfaulted basins began to retain bolson/alluvial fan sediments. Deposition may have resulted from progressive deformation of the change to mafic volcanism. Increasing aridity may also have been a factor.

Basin-and-range faulting affected Trans-Pecos Texas during the Hemingfordian (early Miocene), and continues. This tectonism faulted the later Arikareean-Hemingfordian alluvium by reactivating old faults and creating new ones. Basin-and-range faulting shifted, deepened, and more completely restricted basins of deposition by forming a series of northwest oriented grabens which received great thicknesses of later Miocene and younger alluvium. (See Figure on page 615).

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Stromatoporoid Biostratigraphy—A Case History

Stromatoporoids have a "plastic" morphology which makes them sensitive indicators of paleoenvironments but which presents problems for stratigraphic correlation. A zone at adjacent outcrops may have different genera and species. Nevertheless, stromatoporoids can be useful to determine the time framework of strata.

An *Amphipora* Zone has been recognized for years in the Mid-Continent North American Middle Devonian. Range charts also have been made previously, and at least one work has established several stromatoporoid zone fossils, but authors have noted difficulties of correlation.

A small fauna was collected from two adjacent localities in the Niagara Peninsula of Ontario, near the contact of the Onondaga Limestone with the underlying Bois Blanc Formation. The fauna consists of seven species belonging to three genera (22 specimens), not a statistically significant number. However, the stratigraphic ranges of previously reported occurrences of the species accurately determine the correct age when equated to the continental European standard section. The plotted ranges are based on systematic works in which descriptions and illustrations can give some idea of the validity of species identifications. Stratigraphic works with species lists which cannot be documented were not considered.

The longest ranging species is *Stromatoporella granulata* from the lower middle Siegenian well into the Frasnian. Other previously described species in the fauna are confined to the Eifelian, especially to the lower Eifelian. Three species (representing 77% of the specimens collected)—*S. granulata, S. selwyni,* and *S. tuberculatum*—were all previously reported many years ago from the "Corniferous" Limestone at Port Colborne by H. A. Nicholson. *S. selwyni* has also been reported from the basal Jeffersonville Limestone of Indiana. *Stictostroma excellens* and *Stromatoporella perannulata* are described from the area for the first time. Both have been described previously from the Jeffersonville Limestone; *Stictostroma excellens* from Indiana and *Stromatoporella perannulata* from Kentucky. One specimen is compared with *Stromatoporella composita* Yavorsky. Although Yavorsky's species is not conspecific, it is morphologically similar enough to be of stratigraphic significance. Yavorsky's species comes from the lower Eifelian beds on the margin of the Kuznetz basin.

A question has been raised as to whether Nicholson's fauna reported from nearby Port Colborne came from Onondaga or Bois Blanc beds. Despite of the relatively small number of specimens, one can say that due to strong faunal similarities, Nicholson's material came from the same zone as the material herein reported and further, that both faunas are probably lower Eifelian in age, equivalent to the Edgecliff Member of the Onondaga Formation, which is in agreement with previous correlations based especially on corals and brachiopods.

Although stromatoporoid faunas may differ significantly from outcrop to outcrop at the same stratigraphic zone, and although stromatoporoid faunas are frequently represented in collections by small numbers of specimens, they can give a good indication of their position in geologic time when the identified taxons are compared with the world literature.

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Prediction of Depth and Velocity on VSP Data

The Vertical Seismic Profile (VSP) method can often be used to assist in making drilling decisions. These decisions may involve anticipation of overpressured zones, distance to the seismically determined target, and verification of geologic or geophysical interpretation.

A VSP is recorded with a seismic source on the surface and receivers in the borehole. Both up and downgoing waves are recorded and are separable. Layers beneath the borehole are recorded in the upgoing waves at every receiver position. This redundancy can be exploited to achieve a high signal-to-noise ratio and good quality time-amplitude information. The conversion of amplitude to acoustic impedance gives time and interval velocity with density held constant. Depth is then a function of time and interval velocity.

A VSP has several advantages over surface seismic data in inversion. These include knowledge of attenuation, waveform, and multiples from averaging downgoing waves. The borehole coverage allows use of a control zone for establishing optimal inversion parameters. Averaging of upgoing waves gives an unusually good signal-to-noise ratio so that deconvolution with the averaged downgoing waves yields an excellent estimate of primary reflections. These considerations, combined with the favorable geometry of the VSP, provide for considerable accuracy in estimation of velocity and depth below the bit.

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Morphological Variation of the Ostracode *Krithe*

Ostracodes, like other organisms, react to a changing environment by altering their morphology. This paper reports how the recent ostracode *Krithe* changes when temperature, oxygen, salinity, and depth vary. Eight specimens were chosen from varying localities in the north and south Atlantic Oceans. Although temperature and salinity did change in these locations, they did not vary enough to warrant study. Due to a lack of oxygen data, depth was the only environmental parameter available for examination. The Theta-Rho analysis technique was used to study the specimens. Marginal outline, anterior and posterior vestibules, and pore canals were all examined to see if they changed with depth. The outer margin area did not change in any consistent way with increasing depth. The area of the posterior vestibule decreased with increasing depth, and the anterior vestibule showed a possible trend for the area of increasing with increasing depth. Finally, the pore canals did seem to change with a variation in depth, but no direction for this change was found. It is suggested, in conclusion, that further studies use a larger number of specimens, so that any indicated trends can be better substantiated.

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Application of Strontium Isotopes to Origin of Smackover Brines and Diagenetic Phases, Southern Arkansas

The abundance of the isotope ^{87}Sr is variable in nature, as it is the radiogenic product of ^{87}Rb decay. The relative amount of this Sr isotope that is dissolved in a brine, as expressed by the $^{87}Sr/^{86}Sr$ ratio, might be used as a tracer of the origin and subsequent history of the brine, including its diagenetic effects in petroleum reservoirs. Strontium isotopic analyses of 40 brines from oil fields in southern Arkansas have been conducted to investigate the sources of the dissolved Sr, the pathways of brine migration, and the relationship between the brines and diagenetic phases in the Jurassic upper Smackover Formation. The $^{87}Sr/^{86}Sr$ ratios of 33 brines from the upper Smackover lime-grainstone range from 0.7071 to 0.7101; seven brines from formations stratigraphically above the Smackover range from 0.7090 to 0.7112. Thus the Sr in these brines is variably more radiogenic than Jurassic sea water