Piston cores to 6 m in length from the South Arm of Great Salt Lake, Utah, have been correlated. Radiocarbon ages indicate a record greater than 30,000 y.b.p. Sediments are divided into 4 units (I to IV, top to bottom). Units I, II, and IV contain laminated mud and pelleted mud with brine shrimp egg capsules; III consists of disrupted (bioturbated) sediment containing two ostracod assemblages.

The position of a volcanic ash (Mt. Mazama, Oregon, ~7,000 y.b.p.) has been traced across eleven cores. Aligned pellets and ooids are deposited at the lake margins as parallel flat laminae or thin beds; basinward flaser laminae are present and toward the center disrupted intervals occur. A similar variation is seen in the surface sediment today. The aligned pellets and ooids are interpreted as shallow ($<\sim 5$ m) nearshore current deposits, the flaser laminae as wave-worked deposits, and the disruption is attributed to intrasediment salt growth. Lateral and vertical variations indicate that Unit I sediments have been deposited under relatively shallow (<25 m) saline conditions. The fine laminae of Unit II sediments are wavy and discontinuous. Toward the basin edge carbonate crusts are present. Reworked clasts of soft sediment are evidence that the sediments were bound, while clasts and scours indicate current activity. Unit III sediments are disrupted (bioturbated) with short intervals of primary layering. The ostracod assemblages have wide salinity and depth tolerances, but indicate a deeper fresher lake. Unit IV contains fine parallel flat, wavy and lenticular laminae and is interpreted as a shallow, saline subfacies.

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Stacked Log Curves: Aid to Multiple Well Exploration Studies

Stacked Log Curves is a graphic display of equivalent log traces from multiple wells, drawn side by side. The Stacked Curve System utilizes digital log data residing in the user's data base. The log traces can be plotted at regular intervals or spaced according to the geographic location of the wells. Interactive graphics technology is the ideal vehicle for this application.

The uses of Stacked Log Curves range from quality control to exploration. Typical data problems easily detected by this display are improper digitizing scales, misidentified curves, and data gaps. Simple statistical and mathematical functions may be applied to the curves, permitting computation of zero shift and sensitivity correction factors. These values are used for curve normalization to compensate for differences in logging tools and borehole environments.

Varying the spacing between wells will produce displays ranging from a geologic cross section to a pseudo seismic section. Markers can be picked, corrected, and displayed for all wells, thus assuring accuracy in tracing horizons across long distances. By plotting computed curves such as porosity and lithology percentages, porosity pinch-outs and facies variations can be recognized. Overlaying Stacked Log Curves of appropriate traces can single out zones of interest. After converting from depth to a time scale, these plots can be directly compared with the seismic section.

The raw log data, the corrected and normalized log data, and the marker picks are stored in the computer for further analysis and mapping.

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Geochemistry of Gaseous Hydrocarbons Adsorbed in Shallow Sediments Offshore Santa Barbara, California

An offshore geochemical surface survey was conducted west of Santa Barbara, California. Two hundred sediment samples were taken in an area of approximately 400 sq km. The samples were degassed and the gases analyzed by gas chromatography and isotope mass spectrometry. GC-MS techniques were applied to the extracts of several samples to look for C_{28} and C_{29} steranes. In addition, grain size determinations and fluorescence analyses were carried out on selected samples. The analytical results, mainly the $^{13}C/^{12}C$ ratios of the methane, allow discrimination between (1) an area of exclusively bacterial methane and (2) an area where thermogenic (petroleum-related) hydrocarbons are present.

The area of biogenic gases is characterized by isotopically light methane in the range of $\delta^{13}C_1 = 90$ ppt. High methane yields occur up to 50,000 ppb.

The area of thermogenic gases is characterized by $\delta^{13}C_1$-values in the range of -44 ppt which correspond to methane originating from predominantly marine source rocks (type II kerogen) within the oil window. The methane yields are approximately 200 ppb. Three oil fields, not yet in production, are situated within the area exhibiting the shallow, thermogenic methane. This observation supports the conclusion that hydrocarbons can migrate to the surface from deeper source rocks or from deep gas and oil reservoirs where they can be identified by isotope geochemistry. The application of this methodology to the field of hydrocarbon exploration is obvious.

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"Mud-Line": Modeling its Position Relative to Shelf Break

The "mud-line," the depth of substantially increased silt and clay content commonly occurs near, but is only rarely coincident with, the shelf-to-slope transition. An evaluation of the mud-line off the United States East Coast and northern Gulf of Mexico highlights discrepancies between depth and position of this horizon and those of the shelf break. (1) Off Cape Hatteras and parts of the West Florida Shelf, off-shelf spillover of sand-size material results in a mud-line position well below the shelf break. Spillover at Cape Hatteras is a response to the powerful northeast flow of the Gulf Stream that tangentially crosses the shallow, narrow shelf. (2) The shallower depth of the mud-line off the Mid-Atlantic states between Norfolk and Wilmington canyons, and off the Panama City, Florida, margin identifies the long-term signature of energy concentrated on the sea floor; erosion results from the interplay of several mechanisms, including fronts, storm waves, tides, and breaking internal waves. The mud-line at these localities thus defines the position where, over time, shear-induced resuspension has largely exceeded the threshold of sediment transport. (3) The near-coincidence of the mud-line with the shelf break at the head of Hudson Canyon is a response to physical oceanographic parameters and to off-shelf spillover; involved are the intersection of density fronts separating shelf and slope waters, and the channelizing effect of the canyon head cut deeply into the outermost shelf. (4) Considerable shallowing of the mud-line and a marked departure between this level and the shelf break occur on margins where large amounts of sediment are supplied. Large asymmetric shoreward swings of the mud-line on the Gulf of Mexico margin west of De Soto Canyon record Mississippi and other river input and its extensive lateral dispersal by regionally important mass flow.

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Preliminary Study of Distribution and Transport of Radium, Radon, and Their Alpha Emitting Daughters Using Nuclear Emulsions and Polonium-210

Drill cores obtained during the drilling of the Bendix/Department of Energy radon emanometry grid, Red Desert, Sweetwater County, Wyoming, have been analyzed for Polonium-210 and studied using alpha sensitive, nuclear emulsions. These nuclear track plates provide descriptive information on the physical distribution of U-238 and its alpha emitting daughter products. Microscopic examination of exposed and developed plates on which non-ore zone core samples were dispersed suggests that U-238 and its long-lived daughters U-234, Th-230, and Ra-226 deposit on grain surfaces in very low concentrations (U-238 in sub-picogram amounts). Many of these atoms are bound to the surfaces so lightly that they, as well as Rn-222, are free to enter the underlying emulsion where their decays are recorded. Concentrations of alpha activity usually associated with discrete uranium minerals were not observed. Ra-226 appears to be more mobile than Rn-222. Measurements of Po-210 in the sequential decay, Rn-222 (3.8 days) $\rightarrow$ Pb-210 (22 years) $\rightarrow$ Po-210 (138 days), provide an indirect means of estimating the number of Rn-222 atoms that have decayed in a sample over the last 80 to 100 years. Many Po-210 highs have been observed in the Red Desert cores, some directly associated with uranium mineralization. To date, evidence for the predicted Po-210 concentration gradient produced by the decay of mobile, unsupported Rn-222 either in transit to the surface or over short distances, has not been found. These Po-210 analyses and microscopic studies suggest that observed Rn-222 and Po-210 surface anomalies may be associated with widely dispersed very low concentration halos of Ra-226 or its longer lived parents which surround the ore.

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Depositional Provinces of Paleozoic and Uppermost Precambrian Rocks in Great Basin, Western United States

From late Precambrian to Late Devonian time, shallow-water carbonate strata were deposited on a broad continental shelf along the west margin of North America in a region that is now the Great Basin. This deposition created a wedge of sedimentary rocks, the Cordilleran miogeocline, that thickens from about 1,000 m in cratonic areas in central Utah to nearly 10,000 m in central Nevada. Abrupt facies changes along the west margin of the miogeocline reflect depositional provinces from outer continental shelf to continental slope. Farther west in the Great Basin, coeval rocks consist mainly of shale, radiolarian chert, quartzite, and mafic pillow lava, considered to be mainly deep-water oceanic deposits.

Depositional provinces of the Great Basin were markedly changed by the Antler orogeny during Late Devonian and Early Mississippian time. This orogeny created the Antler highland, an upland belt trending north-northeast through central Nevada, along the former edge of the continental shelf. During Mississippian, Pennsylvanian, and Permian time, the Antler highland was either emergent or the depositional site of thin shallow-marine or continental coarse detrital sediments and shallow-marine carbonate. A foreland basin east of the Antler highland received thick deposits of coarse, chert-rich detritus during Mississippian and, to a lesser extent, Pennsylvanian and Permian time. A shallow-water carbonate shelf lay east of the foreland basin. Mississippian, Pennsylvanian, and Permian rocks west of the Antler highland consist of shale, sandstone, conglomerate, radiolarian chert, silty limestone, and mafic lava, all deposited in a deep-water oceanic environment.

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Geology and Hydrocarbon Potential of Antarctica

Antarctica covers approximately 14 million sq km, an area greater than the United States and Mexico combined. About 98% of this expanse is buried beneath a continental ice sheet having an average thickness of 3,000 m.

Seven nations have territorial claims to parts of Antarctica; however, parts remain unclaimed. The 1959 Antarctic Treaty, extending to 1991, freezes territorial claims for its duration. The treaty does not cover mineral or hydrocarbon exploration or exploitation.

Available data indicate the presence of 13 major sedimentary areas or basins on or fringing the Antarctic craton. Published descriptions of sedimentary outcrops in Antarctica plus litho-paleogeographic plate reconstructions and consideration of the stratigraphy of the adjacent landmasses allow prediction of sediment age and lithology in the 13 basins. The sediments are predominantly clastic. The onshore basins contain some Paleozoic sediments but the offshore basins are anticipated to contain only Mesozoic and Cenozoic sediment. Five of the 13 basins are onshore and subglacial whereas eight are considered as offshore basins. Five of the offshore basins are accessible with today's exploration technology and of these, three are considered highly prospective for hydrocarbons. Preliminary exploration efforts are beginning in this truly virgin area and future development will be exciting to watch and, hopefully, participate in.

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Kaolinite Formation in Clastic Reservoirs: Carbon Dixoide Factor

Thermodynamic modeling of diagenesis in clastic reservoirs was used to quantify geochemical and geohydrologic constraints on the formation of kaolinite. The formation of significant amounts of kaolinite depends upon four conditions: (1) a source for aluminum; (2) the presence of acidic pore fluids; (3) the pH buffering capacity of the fluids; and (4) the quantities of such fluids moving through the reservoir. The first condition is usually satisfied by the unstable mineral assemblage. The second and third conditions can depend upon CO_2 released during hydrocarbon maturation, and the final condition requires an open system.

The presence of dissolved CO_2 buffers the pH so that the pore solution is undersaturated with respect to illites, chlorites, and smectites while kaolinite is being precipitated. Minimum limits of fCO_2 in equilibrium with fluids forming appreciable amounts of kaolinite were computed as a function of unstable