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USE OF RADIOGRAPHY IN STUDYING TEXTURAL AND STRUCTURAL PROPERTIES OF ANCIENT ARGILLACEOUS SEDIMENTS WHICH AID IN INTERPRETATION OF ANCIENT ENVIRONMENTS

Several investigators have used radiography to study sandstone, siltstone, and recent sediments. In studying fine-grained sediments, radiographic techniques, if used alone or in conjunction with other techniques such as X-ray diffraction, electron microscope, petrographic and binocular microscope, chemical and field techniques, can add materially to knowledge of the structures and textures of fine-grained sediments. Some of the advantages of the radiographic techniques are: (1) larger and thicker samples can be used; (2) the techniques save time; (3) structure and texture are observed clearly on film which might be missed by other methods of investigation; and (4) the relation of the various structural and textural features can be observed for the entire specimen. Some of the disadvantages are: (1) microstructures cannot be observed; (2) structural and textural features having the same absorption capacity for X-rays are not recorded on the film; and (3) film is not easily studied microscopically for microscopic structures and textures.

Some of the structures which have been observed are cracks, trails by animals, slickensided surfaces, concretions, fossils, small faults which cut only a few laminae, erosion of one or more laminae, flow structures, expansion and contraction of the same laminae laterally, and vertical transition from well-laminated to poorly laminated sediments. The textural features shown are graded bedding, differences in the thickness of laminae, smaller laminations in thicker laminae, and some radiographs of mudstone that look like fleecy clouds.

All these structures and textures are related to the environments of deposition and to the environments during consolidation after deposition.

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ECONOMICS OF OFFSHORE EXPLORATION AND PRODUCTION

Time, iron, and technology are the key words for economics of offshore exploration and production.

Timing for opportunities (lease sales) has an important bearing on overall economics both for individual operators as well as the industry. Real time means money in view of significant investments made in the early part of exploration and production cycle. When present value profit is employed as an economic criterion, environmental, operational, and political delays, and the time value of money, become most critical.

Sheer tonnage of steel for platforms, facilities, support activities, *etc.* is a considerable item in addition to the cost of fabrication and engineering required. Platform costs in the Gulf of Mexico go up at the rate of roughly $1 million for each 100 ft of water depth. Cook Inlet platforms cost approximately eight times those for comparable water depths in the Gulf. Cash flow for model cases in the Gulf of Mexico shows the importance of time as related to the heavy development capital outlays and allowable production rates.

Technological capabilities are not a serious limiting factor in offshore operations, even including underwater facilities in continental shelf depths. The industry does not lack for unique and novel concepts of underwater operations, and engineering science will solve the problems if appropriate incentives exist.

Geological interpretation and economic incentives are perhaps the more serious limiting aspects. Better predictability and interpretation of geologic structures and reservoir conditions are desirable prerequisites for recognition of the large investments characteristic of offshore operations. The Department of Interior's recent publication, *U.S. Petroleum Through 1980* recognized that ". . . cost is the key to future petroleum availability."

J. TUZO WILSON

CONTINENTAL MIGRATION

(No abstract submitted)

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GEOLOGY OF SOUTHERN SWAIN REEFS AREA, QUEENSLAND, AUSTRALIA

Aeromagnetic and marine-seismic prospecting across the southern Swain Reefs and adjacent waters, central Queensland, Australia, preceded the drilling of two stratigraphic tests in 1967 and 1968.

Outcropping rocks onshore are Silurian(?) to Permian eugeosynclinal sediments and volcanic rocks, intruded by granite of Carboniferous to Mesozoic ages. This rock complex is overlain unconformably by 20,000 ft of Mesozoic nonmarine or shallow marine clastic and volcanic rocks in the onshore part of the Maryborough basin, 100 mi south. Onshore Tertiary rocks are thin nonmarine terrigenous clastic strata and basalt flows. Tertiary trachyte plugs are present locally.

Geophysical surveys and drilling have outlined offshore structural elements tentatively named (1) Swain Reefs high, an area of shallow Paleozoic(?) basement overlain by undated volcanic rocks and coinciding with the Swain Reefs at the southern end of the Great Barrier Reef, and (2) the Capricorn embayment, a half-graben 20–70 mi wide, trending NNW along the southwestern side of the Swain Reefs high. Normal faults separate the two features. The embayment contains 0–8,000 ft of Tertiary marine shale, marlstone, lignitic shale, and sandstone; 3,100 ft of Cretaceous(?) sandstone, shale, and conglomerate, possibly equivalent to the Lower Cretaceous Maryborough Formation; and more than 1,200 ft of conglomerate and volcanic rocks of the Upper Jurassic-Lower Cretaceous Graham's Creek Formation. This section is present at the southeast end of the graben near its intersection with the continental shelf. The graben is bounded on the southwest by the Bunker-Capricorn high composed of Mesozoic volcanic rocks of unknown thickness. The volcanic rocks are overlain unconformably by thin marine Tertiary strata which thicken eastward into the Capricorn embayment. Mesozoic sedimentary and volcanic rocks of the Maryborough basin are present southwest of the high and are separated from it by normal faults. These features are the result of block faulting during the Tertiary controlled by pre-Mesozoic deformation with a strong NNW grain.

Capricorn No. 1-A was abandoned at 5,609 ft in Mesozoic volcanics; Aquarius No. 1 was abandoned at 8,696 in Paleozoic(?) metamorphics. There were no shows of oil or gas.