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Interaction of Living Radiolarians and Their Environment

Studies of living radiolarians in the field and in the laboratory reveal the extent of their trophic diversity. Solitary and colonial radiolarians feed opportunistically on a wide variety of prey organisms in nature, but respiration studies have shown that they can rely heavily on their symbiotic algae to provide the energy required for basal metabolism. Some radioisotopic evidence has implicated an intricate relationship between the host, its predatory success and the photosynthesis by its symbionts.

Field data on the abundance of subtropical radiolarians suggest that their populations respond to seasonal changes such as temperature. The existence of separate cohorts in a population suggests that several life cycles may occur in a single season lasting only a few months.

Such studies will amplify our understanding of the interactions of the radiolarians with the biological component of their environment based on their nutritional requirements and physiological limitations. This is an important first step towards elucidation of which factors affect the distribution of radiolarians.

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Application of Integrated Reservoir Analysis to Design of a Waterflood Project in Miocene LL3 Field, Lake Maracaibo, Venezuela

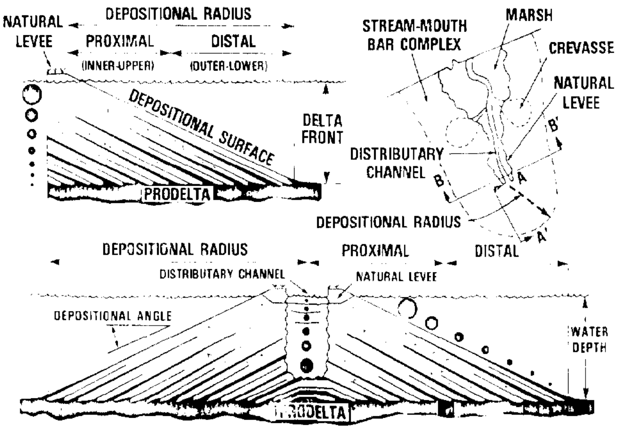
Integrated Reservoir Analysis is a procedure where interpreted stratigraphic and facies frameworks are combined with structural analysis to produce more accurate and appropriate reservoir maps. The result is a three dimensional interpretation of the thickness, shape, lateral extent, and internal distribution of porosity and permeability in individual reservoir units. The principal steps of the procedure are: (1) planning, (2) data gathering, (3) determination of the stratigraphic framework, (4) determination of the facies framework, (5) structural analysis, (6) data manipulation, and (7) mapping.

The stratigraphic framework is developed by combining pattern correlation techniques with knowledge about the influence of specific facies on stratigraphic patterns. A network of cross sections are designed utilizing correlation "grain" and/or depositional strike. Correlations on these sections develop a framework of horizons which ideally will isolate, in a stratigraphic envelope, individual reservoir units resulting from a unique depositional episode.

The facies framework results from environmental facies analysis and the use of electric log facies. The proper identification of reservoir facies is required for the mapping of reservoir geometry and the determination of the internal distribution of porosity and permeability. Facies-biased contouring techniques and the lateral extension of facies relationships along cross sections were used in the planning and design of a waterflood project by Lagoven, S.A., in fluvial-deltaic clastics of the Miocene La Rosa Formation in the LL3 field, Lake Maracaibo, Venezuela. Important clastic reservoir facies recognized in cores were (1) stream-mouth-bar, (2) distributary-channel-fill, and (3) fluvial point-bar deposits. These environmental facies often occurred in various combinations in deltaic lobes and displayed the electric log shape of the deltaic couplet. Characteristic electric log shapes of specific reservoir facies were an essential part of the study.

The pilot waterflood was designed to inject into stream-mouth-bar facies and withdraw from centrally located distributary-channel-fill deposits with their better porosity and permeability. Critical to the design and subsequent performance of the waterflood project were (1) the distribution of porosity within the various reservoir facies, and (2) the occurrence, attitude, and lateral distribution of clay laminations within the lower stream-mouth-bar and upper fluvial deposits. The influence of clay laminations in lower stream-mouth-bar facies was particularly critical to waterflood performance. They were deposited on the distal slope of the stream-mouth-bar at a slight angle to the rock unit boundaries and therefore could mask parts of the reservoir from waterflood treatment. The amount of masking was determined by calculations from facies geometry. After one year's operations, radioactive tracers indicate that the flood is operating as designed only at a reduced rate—probably as a result of the clay laminations.

MODEL OF STREAM-MOUTH BAR COMPLEX
(SHALLOW WATER)



Integrated Reservoir Analysis can be useful not only to production operations such as waterflood projects, infill drilling, recompletions, and reserve estimates, but a similar procedure could also be applied to exploration activity in mature areas with plentiful log data.

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Modeling Basin Subsidence and Stratigraphy: Blake Plateau Basin

Blake Plateau basin on the continental margin off Georgia and Florida contains 12 to13 km (39,000 to 43,00 ft) of Jurassic and younger sedimentary rock. Although such thicknesses of strata are common to sedimentary basins off the eastern United States, the Blake Plateau basin is underlain by unusually thick basement rocks (20 to 24 km; 66,000 to 79,000 ft) and is much wider (350 km; 220 mi) in comparison with other basins. Simple extensional models for the basin's origin would suggest thinner basement to correspond with the observed sedimentary thicknesses, i.e., basement 4 to 16 km (13,000 to 52,000 ft) thick. In contrast, a two-dimensional gravity model across the continental margin details the anomalous crustal structure. The basement is about 30 km (98,000 ft) thick under the shelf; 18 km (59,000 ft) under the basin, thickening seaward to 24 km (79,000 ft) under the basin's eastern edge; and 6 km (20,000 ft) thick seaward of the Blake Escarpment.

The basin's subsidence history places limits on possible models of the crustal development of this part of the margin. Because of the paucity of well data, a detailed "backstripping" analysis of the stretched continental-crust area is not possible, but an estima-