Abstracts

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New Techniques for Clay Mineral Identification by Remote Sensing

In the past three years there have been major advancements in our ability to identify clay minerals by remote sensing. Two different technologies have been used—imaging broad-band multispectral scanners and non-imaging narrow-band radiometers and spectrometers.

Multispectral scanners, including NASA's Thematic Mapper Simulator (analog for Landsat-D Thematic Mapper) have had several broad-band channels in the wavelength region of 1.0 to 2.5 μm. In particular, the wavelength region 2.0 to 2.5 μm contains diagnostic spectral-absorption features for most layered silicates. Computer processing of image data obtained with these scanners has allowed the identification of the presence of clay minerals, without, however, being able to identify specific mineralogies. Studies of areas with known hydrocarbon deposits and porphyry copper deposits have demonstrated the value of this information for rock-type discrimination and recognition of hydrothermal alteration zones.

Non-imaging, narrow-band radiometers and spectrometers have been used in the field, from aircraft, and from space to identify individual mineralogical constituents. This can be done because of diagnostic spectral absorption features in the 2.0 to 2.5 μm region characteristic of different clay types. The Shuttle Multispectral Infrared Radiometer (SMIRR), flown on the second flight of the space shuttle Columbia in 1981, had 10 narrow-band channels specifically chosen to evaluate the ability to identify directly clay minerals and carbonates. Preliminary analysis of SMIRR data over Egypt showed that kaolinite, carbonate rocks, and possibly montmorillonite, could be identified directly.

Plans are currently under way for development of narrow-band imaging systems which will be capable of producing maps showing the surface distribution of individual clay types. This will represent a major step in remote sensing, by allowing unique identification of minerals rather than the current ability only to discriminate among materials. Applications of this technology will provide geologists with a powerful new tool for resource exploration and general geologic mapping problems.

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Seismic Reflection Surveys in Central Palo Duro Basin

Seismic reflection surveys have been conducted in the central Palo Duro basin to provide a basis for identifying localities suitable for the emplacement of an underground high level nuclear waste repository. The objectives of this effort were to determine the structure and stratigraphy in the central Palo Duro basin and evaluate the potential for hydrocarbon resources.

Of primary interest is the Upper Permian salt section to a depth of about 3,000 ft (914 m). Various tests were carried out along a 3 mi (5 km) segment to determine the most appropriate combination of vibrating source and recording parameters. Approximately 130 mi (209 km) of 24-fold CDP stacked data were acquired. The survey lines were tied to test wells in which velocity surveys were conducted.

These data were supplemented by about 400 mi (644 km) of available proprietary CDP stacked data. Analysis of these data strongly suggests that central Palo Duro basin has been tectonically stable since Early Permian time. The basement, which is not an acoustic interface, is offset in a few places by faults. The maximum offset of the basement is about 600 ft (183 m). These basement faults do not appear to affect any strata above. The San Andres Formation and underlying formations can be traced continuously throughout the area surveyed. Available velocity data from various wells in the central Palo Duro basin show few anomalies, confirming the continuity of the reflecting horizons and the tectonic stability of the area.

Hydrocarbon potential of the area is presently being evaluated. The preliminary results of this study are in agreement with the stratigraphic correlations among well logs in the Palo Duro basin.

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Subsurface Glen Rose Reef Trend in East Texas and West-Central Louisiana

The subsurface Glen Rose reef trend in east Texas and west-central Louisiana (Lower Cretaceous Comanchean) is a regressive carbonate complex deposited on a broad shallow water shelf. The major structural influences on deposition were the East Texas basin and the northwest Louisiana basin, separated by the Sabine uplift. The Glen Rose reef trend can be differentiated into two separate "reef" tracts that prograded seaward over a slowly subsiding shelf. The Upper and Middle reef tracts overlap within the East Texas embayment and diverge over the southern flank of the Sabine uplift eastward into Louisiana. The reef trend appears to be located midway between the shoreline and shelf edge.

It remains to be seen whether the Glen Rose "reefs" are actual framework reefs or mounds of transported material. Cores through the massive limestones reveal porous buildups of varying compositions. "Reef" facies include poorly sorted caprinid-coral grainstones, moderately sorted peloid and oncolite packstones and grainstones, and well-sorted, very fine grained skeletal grainstones. Coated grains, abraded skeletal fragments, scoured bedding surfaces, and minor cross-beds are evidence for deposition of the reef facies in a high-energy shoal setting. The reefal buildups grade laterally into low-energy shallow water wackestones and mudstones containing toucasids, orbitolinids, and serpulid burrows.

Porosities associated with the reefal buildups appear facies controlled. Caprinid-coral packstones and grainstones exhibit intraparticle, moldic, and vuggy porosities of 10 to 15%. Pin-