depth of exploration and resolution of non-radiometric geophysical methods. The first approach is to use EM methods that have not been commonly used such as the controlled-source or natural-field audiomagnetotelluric method which can have a depth of exploration of several kilometers. The second approach is to use advanced geophysical interpretation methods to define responses from the alteration halos around the uranium mineralization. Advanced Induced Polarization surveys may detect such halos as evidenced by applications in Tertiary sedimentary basins.

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Carbonate-Sulfate Mineral Replacements in Diagenesis of Peritidal Limestone

Petrographic study of crystal textures and fabrics, both original and replacement, has revealed the postdepositional history of carbonate and sulfate minerals in the Silurian Tonolway Limestone. Crystal forms, assumed to have been gypsum originally, are locally common in supratidal facies; they occur as coarse euhedral needles, randomly oriented to bedding, and commonly in clusters. When this gypsum precipitated interstitially in the lime sediment, micrite was often incorporated into the crystals; organic matter, concentrated on side faces, may have blocked nucleation, causing the fibrous crystallization texture. As a consequence of the changing chemistry of pore fluids, a series of mineral replacements began within these crystal forms. Gypsum was first replaced by celestite, as evidenced by its pseudomorphism. The enclosing aragonite sediment inverted to calcite, and strontium was thus freed for the making of celestite. Afterwards, calcitization of the sulfates took place, i.e., each crystal was replaced by a mosaic of very finely crystalline calcite. Calcitization began around inclusions of micrite within the crystal forms. Presumably, decomposition of algal material produced carbon dioxide that was used for the calcitization reaction. Sulfate ions released by this last replacement inhibited the growth of calcite, resulting in its very fine crystallization fabric. Lastly, these calcite "pseudomorphs" were themselves partly replaced by limpid dolomite.

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Coastal Swamp Origin of San Miguel Lignite Deposit, Jackson Group, South Texas

The environments of deposition of the San Miguel lignite, a commercial quality deposit in a 4.5 by 0.3-km area in Atascosa and McMullen counties, Texas, was determined through analysis of nearly 122 m of continuous core and over 600 electric and radiation logs. The lignite is in the Jackson Group and is part of the south Texas Eocene lagoonal-coastal plain system.

The lignite is overlain and underlain by a unit of gray-green bioturbated siltstone and claystone 33.9 m thick. The lack of body fossils and abundance of root structures indicates this unit was deposited in a coastal grass-flats environment.

Below the bioturbated unit is a unit of massive green claystone 3.4 m thick, which contains abundant macroinvertebrate fossils. The fossils indicate this unit was formed in an open bay or lagoon.

Below the green claystone is a coarse, carbonaceous sandstone 3.6 m thick. Sedimentary structures and petrographic trends of this unit are analogous to those of modern back-barrier flats deposits.

The lignite interval is composed of lignite and carbonaceous clay partings of 4.2 m average thickness. The lignite interval has an overall strike-trend with local dip-trending segments. The lignite represents the accumulation of plant matter in a coastal swamp behind a lagoon. The clay partings formed during occasional flooding of the swamp by coastal streams.

Analysis of sedimentary structures, petrography, and paleontology from continuous cores is considered essential to oil and gas exploration. This study demonstrates these techniques are also important in lignite exploration.

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Anomalous Thermoluminescence Around Uranium Deposits

Radiation damage to crystal structures may be detected using thermoluminescence (TL). Quartz and feldspar grains separated from rocks that were once mineralized with uranium display an anomalous TL characterized by an increase in high-temperature TL relative to low-temperature TL. This anomalous TL may be detected by either examining the ratio of low-temperature TL to high-temperature TL or a graph of TL intensity versus temperature. One of these methods of comparison must be used to normalize the variation in the susceptibility of the samples to TL. Without this normalization, the variation in the susceptibility could mask the anomalous TL caused by mineralization. After a uranium-mineralized rock has been leached of uranium, this type of anomalous TL persists for geologically significant lengths of time. Consequently, TL may be used to identify formerly mineralized rocks. Studies of TL around uranium deposits indicate that this type of anomalous TL is present in rocks updip from migrating roll-type deposits (one in Texas and one in Wyoming), around the margins of a partly leached tabular deposit in Utah, and in leached outcrops above a vein-type deposit in Colorado.

TL may be a very practical prospecting guide; it is inexpensive, fast, and easy, requires little sample, and is a direct indicator of uranium mineralization rather than of a concomitant process. Further, Tl samples are less susceptible to contamination than other types of geochemical samples.

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Depositional Models for Fine-Grained Sediment in Western Hellenic Trench, Eastern Mediterranean

Sediments in tectonically active, topographically re-