north of Little Bahama Bank, can be divided into upper and lower slopes. The upper slope is relatively steep (2 to 4°) and heavily dissected by numerous, roughly evenly spaced submarine canyons or gullies that display 50 to 100 m of relief. The seismic facies of this upper slope consists of parallel to subparallel reflectors. Core data indicate that most sediments on this upper slope, including those immediately adjacent to shallow-water reefs, are fine-grained periplatform oozes. Core data combined with 3.5 kHz PDR profiles reveal a gradual downslope decrease in the amount of submarine cementation. Where cementation is not an important factor, submarine sliding begins, probably due to overloading.

In contrast, the lower slope is a broad, smooth, relatively gentle (~ 1°) region with few canyons. The seismic facies here consists of chaotic/discordant to wavy, subparallel reflectors. Core data indicate a dominance of coarse-grained debris flow and turbidity current deposits, interlayered with minor pelagic sediments. Most of the coarse detritus in these sediment gravity flows was derived from the upper slope. Pelagic sedimentation, incipient submarine cementation, and mass movements interact to produce very coarse-grained material on the lower slope from initially fine-grained upper slope sediments. Numerous unlithified deep-water coral mounds are also present on the lower slope.

The morphology and sedimentary/seismic facies relations of this carbonate slope indicate sedimentation from a line source rather than a point source. In contrast to submarine fan development from a point source, base of slope sedimentation along a line source produces a broad apron of coarse sediment, gravity flow deposits on the lower slope paralleling the shelf/slope break. In terms of hydrocarbon exploration the lower slope sediment gravity flow facies appears to have the greatest potential as a reservoir.

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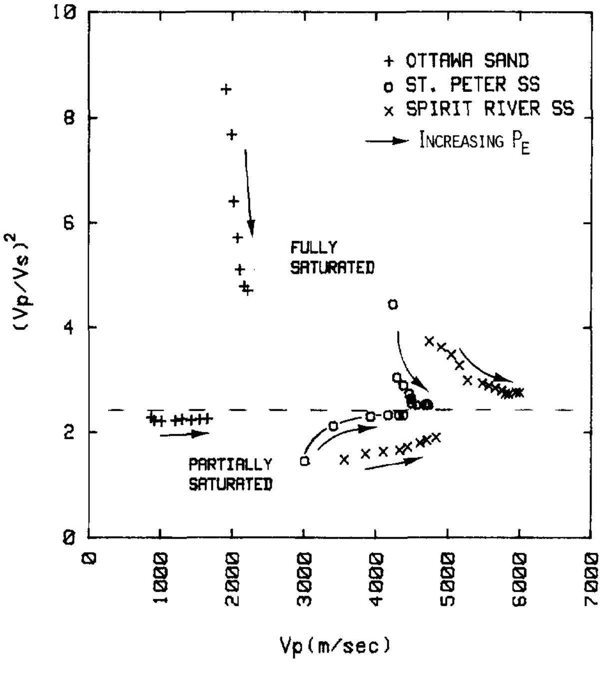
Diagenesis of Marine Sands to Tight Gas Sands: Effects on Acoustic and Hydraulic Properties



The primary stages of diagenesis of marine sands usually increase total grain contact area, increase the number of contacts, decrease porosity, and increase pore network tortuosity. These microstructural factors strongly affect the continuum acoustic and hydraulic properties of the sands. To better understand diagenetic effects on these properties, compressional and shear wave velocities, V_p and V_s, and their specific attenuation, $Q_p{}^{-1}$ and $Q_s{}^{-1}$, were measured in an unconsolidated quartz sand (Ottawa sand, porosity ≈ 35%), a quartzarenite sandstone (St. Peter sandstone, porosity ≈ 22%), and a lithic-quartz arenite (Spirit River tight gas sand, porosity ≈ 5%). Measurements were made under effective pressures, P_e, up to 350 bars as a continuous function of partial gas saturation, at frequencies from 10 to 15,000 Hz, and from 150 to 500 kHz. Experimental results are explained with relations derived from contact and packing theories. Results suggest that V_p/V_s and $Q_p{}^{-1}/Q_s{}^{-1}$ may be used to distinguish between gas and consolidation effects in reflection seismology and borehole sonic logs. Gas permeability was also measured in Spirit River tight gas sands from the Alberta Deep Basin as a function of effetive pressure and partial gas saturation. These values are compared with known values for quartz sands and sandstones, and the results are examined with simple pore network models. While porosity decreases by a factor 7 from Ottawa sand to Spirit River sandstone, gas permeability drops by as much as 8 orders of magnitude. Gas permeability in all granular sedimentary materials, especially the tight sands, is a strong function of clay content, partial gas saturation, and effective pressure.

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Relation of Calcite Cementation and Uranium Mineralization in South Texas

Host sandstones for uranium ore in the Miocene Oakville Formation commonly show strong calcite cementation. These hard, limy ledges are found in the area of the mineralization front and over the barren interior. They commonly occur at the top and the base of the host sandstone body, while the sand in between is only slightly calcareous and highly permeable. Outside the mineralization front, in chemically reduced zones, cementation is less pronounced or absent.

Precipitation of calcite cements occurred both before and after uranium mineralization, and has replaced some of the framework mineral grains. Uranium is usually found in the uncemented part of the sand; in only a few places is it in direct contact with calcite.

Carbon isotope values of the cements are interpreted to indicate that the carbon is the result of contribution from organic matter. Calcite in the highly cemented zone (>30% calcite) has δC^{13} values of −11 to −20 ppt whereas values in the slightly cemented sands of the proto-ore and altered interior range from 0 to −5 ppt. The light carbon in these cements associated with the uranium ores probably entered the sediments as light hydrocarbons associated with the H_2S which precipitated pyrite. Pyrite has been documented in other south Texas deposits as resulting from H_2S generation in the Edwards Limestone at depth with subsequent migration.

It appears that the occurrence of calcite cement is genetically related to the emplacement of uranium ore. The distribution of limy ledges, which can be mapped from electric logs, elucidates the geologic history of a uranium deposit and serves as an aid in exploration.