such a hydrocarbon trap, the updip reservoir seal is created by a zone of porosity destruction due to diagenetic processes associated with the unconformity and the onlap of impermeable red beds of the Jurassic lower Amaranth (Spearfish) Formation onto the unconformity surface.

In 1980, the traditional play concept was challenged at Waskada, Manitoba, with the discovery of significant oil reserves in the top seal. Oil at Waskada field is obtained from 3 stratigraphic intervals in the Mississippian carbonates. Oil migration was not halted at the Paleozoic unconformity, but continued through the unconformity zone until trapped by permeability barriers within the siltstones and fine-grained sandstones of the lower Amaranth Formation.

This discovery has led to a reexamination of the traditional subcrop play and has added a new dimension to exploration in the region. The key to such a subcrop-supracrop play lies in the identification of major paleotectonic structural disturbances in underlying Paleozoic rocks occurring in conjunction with favorable reservoir facies in the overlying top seal. Such traps may presently exist as bypassed pay in other subcrop stratigraphic pools.

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Bahamas: Future Petroleum Province?

The Commonwealth of the Bahamas and its offshore areas, located off the southeasternmost tip of the United States, have experienced only cursory petroleum exploration in the past. Between 1947 and 1971 only 4 wells were drilled; however, the region warrants extensive exploration. New portions of the Great Bahama Bank, where water depths are relatively shallow, have been licensed recently to multinational companies. Recent seismic surveys have indicated encouraging stratigraphic data for much of the Florida-Bahama basin.

This chain of about 700 islands covers approximately 300,000 km^2 (116,000 mi^2) and is characterized by shallow-water carbonate banks that are separated by deep-water channels. Water depths in the Bahamas range from a few meters in the areas immediately adjacent to the islands to as much as 4,000 m (13,120 ft) along the northeast margin of the archipelago.

The Bahamian carbonate platform is underlain by approximately 6 km (3.75 mi) of carbonate and evaporite sediments, making it one of the world's thickest carbonate sequences. Although the presence of reefs, evaporites, and bank carbonates have made the Bahamas an area of scientific interest to petroleum geologists for many years, very little exploration has been conducted in the region.

New seismic surveys of the region, improved drilling methods, and the application of advanced geophysical techniques and geologic concepts improve the probability that this heretofore neglected region could become a future petroleum province.

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Holocene Transgressive Stratigraphy and Sediment Dispersal, Eastern Shore, Nova Scotia

Coastal sedimentation along Nova Scotia's eastern shore is dominated by a rising sea level, restricted drumlin sediment supply, and inherited glacial topography. Evolution of barrier systems follows a 500-1,000 year cyclic sequence of: (1) generation from marine erosion of glacial deposits, (2) transgression resulting from ongoing sea level rise and depletion of original sediment sources, and (3) landward removal following an estuarine retreat path to new sites of reconstruction. The dominant sediment transfer mechanism operating during this transgressive cycle is landward dispersal by tidal inlet, overwash, and eolian process.

Vibrocore, surface sampling, marine geophysics, and underwater photography were used to investigate the potential for eastern shore coastal deposits to be incorporated into the shelf stratigraphic record. High-resolution seismic profiles from the inner continental shelf reveal a lower acoustic unit interpreted as Wisconsinan glacial deposits. Overlying the lower unit is a discontinuous upper unit 1-2 m thick, which occupies topographic depressions and is composed of sand, silty sand, and a coarse gravel lag. Side-scan sonar and underwater photographs show large gravel ripples covering the upper acoustic unit in water up to 30 m deep. The upper acoustic unit is interpreted as the remnants of reworked coastal barriers, drumlins, and till.

Transgressive sedimentation on the eastern shore of Nova Scotia, therefore, conforms to the concept of shoreface retreat. Coastal sediments here are poorly preserved, except in linear shelf valleys, because of a high-energy wave climate and prior landward transfer into tidal deltas, washovers, and associated back-barriers deposits.

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Radiaxial Fibrous Calcite as Early-Burial, Open-System Cement: Isotopic Evidence from Permian of China

The Nanpanjiang basin of south China occupies about 100,000 km^2 in southern Guizhou and eastern Yunnan Provinces and northwestern Guangxi Autonomous Region. The basin contains a thick Paleozoic carbonate sequence overlain by about 3,000 m of Triassic basinal deposits. Permian carbonate rocks comprise a large portion of the Paleozoic strata and form several platforms separated by basins containing dark, thin-bedded limestones, siliceous shales, and cherts. The platform margins are rimmed by sponge or algal reefs.

Radiaxial fibrous calcite (RFC) is the most abundant cement in very coarse sponge or algal debris of Upper Permian reef and fore-reef sediments exposed along the western margin of the Nanpanjiang basin. Small volumes of syndepositional cements, interpreted to have been fibrous magnesian calcites and botryoidal aragonite, predate RFC. Coarse, blocky burial calcite postdates RFC. Evidence that RFC was precipitated during sediment deposition was not found. RFC occurs as isopach layers up to 15 mm thick and exhibits white, gray, and black bands about 1 mm wide. The presence of microdolomite inclusions in these cements indicates that they were originally magnesian calcites. $\delta^{18}O$ of RFC cements are more positive than any of the earlier or later components of the reef and fore-reef facies. Analyses of successive bands reveals the most positive $\delta^{18}O$ near the center of the isopach layers. $\delta^{13}C$ of successive bands reveals generally more negative values toward the centers of layers.

RFC layers are interpreted to have precipitated during early burial of the platform margin while reef and fore-reef sediments were in communication with seawater. Cement layers recorded isotopic characteristics of seawater as platform-edge sediments subsided through the water column at the basin margin. $\delta^{18}O$ of successive bands records cooler water at depth in the basin followed by geothermal warming. $\delta^{13}C$ records increased incorporation of light carbon as the platform subsided through the oxygen minimum zone, followed by a return to normal values at depth.

These data and interpretations suggest RFC layers precipitated very slowly during time spans commensurate with those of subsiding platforms (millions of years). Isotopic characteristics of RFC may not reflect shallow seawater. Rather, they may reflect burial environments where $\delta^{18}O$ is affected by cooler water and $\delta^{13}C$ is affected by biologic activity.

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Practical Use of Inverted Seismic Data

Reliable initial reservoir estimates can be made for a prospect without the benefit of reservoir engineering information. This is done by combining petrophysical data such as sonic, gamma-ray, density, and resistivity logs with inverted seismic profiles and geologic models.

To delineate and appraise the reservoir volume adequately with seismic data, the reduction, processing, and display must be subject to strict quality control. The wavelet must be converted to zero phase, contracted and centered on the reflection coefficient that corresponds to the target beds. The useful spectrum of the data must be as broad as possible to define the geologic boundaries properly. There must be a good estimate of the amplitude spectrum of the wavelet and a successful deconvolution to remove effects of the source signature. Noise maintenance or reduction must precede inversion of seismic data to pseudo-sonic logs. The low-frequency gap in seismic records must be restored deterministically by the use of a geologic model with interval velocities specified. Time-variant processes should be minimized or avoided. A reliable calibration of absolute transit times must be obtained given that the inversion algorithm was stable and satisfied all assumptions involved in its use. Finally, results