The penetrometer produced a continuous profile of sediment cone resistance and was useful in determining recent sediment thicknesses to 1.3 m at several sites. The resistivity probe produced a continuous profile of sediment electrical resistance/conductivity, which is related to sediment wet unit weight and porosity when pore water salinities, temperatures, and average grain densities are constant. The miniature piezometer is a prototype 8-mm diameter probe which measures sediment excess pore water pressures and the dissipation of pressures induced during insertion at various depths below the sediment-water interface. An inclinometer was also mounted on the submarine and continuously measured the sediment slope as the submersible traversed the sea floor.

The use of in-situ geotechnical instruments with a manned submersible provides the opportunity to select sites for detailed geotechnical analysis of specific sea-floor features such as previously slumped blocks, their slump scars, and sediment gravity flow deposits. Although depth of penetration of the submersible-mounted probes is limited to ~1.3 m, valuable detailed in-situ geotechnical data were obtained.

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High Potential Gas Production and Fracture-Controlled Porosity in the Upper Devonian Kane Sandstone, Central-Western Pennsylvania

Cush Cushion field is a small gas-producing tract in central-western Pennsylvania. It lies physiographically within the Pittsburgh Plateau section of the Appalachian Plateau province. The Allegheny Front, which forms the border between the Appalachian Plateau province and the Valley and Ridge province, is 23 mi (37 km) east of the field. Cush Cushion is developed across the Brush Valley synclinal axis in eastern Indiana County. The Conemaugh Group is exposed at the surface and production is from the multistory sandstone reservoirs of the Bradford Group (Upper Devonian) at depths ranging from 2,600 to 3,924 ft (792 to 1,196 m).

The Kane sandstone of the lower Bradford Group is the principal reservoir at Cush Cushion field. The Kane is interpreted as a distributary-channel sandstone associated with the westward progradational Catskill clastic wedge.

Kane sandstone production is fracture controlled at Cush Cushion field. Fracture porosities as high as 13.8% occur along a limited east-west trend. Natural open flows of up to 13.8 MMcfgpd are known from the fractured Kane interval.

A zone of structural discontinuity is recognized at Cush Cushion field. Fracture porosity in the Kane may be related to the local disruption of the regional structural grain. This disruption could represent the extension of a documented cross-structural discontinuity from the overthrust belt into the undetached foreland.

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Future of Uranium Mining in Atlantic Margin

Good prospects exist for the discovery of mineable uranium ore bodies in a variety of geologic environments in the Atlantic margin. Development is farthest along in the Canadian Maritimes, at Kitts-Michelin in Labrador, through extensive exploration in New Brunswick, at Johan Beetz and other pegmatite areas on the Quebec north shore, and in the South Mountain batholith in Nova Scotia. Targets of interest in the United States include Precambrian crystalline rocks in the Green Mountain massif in Vermont, the Reading Prong-Hudson River Highlands in New York-New Jersey, and Grandfather Mountain in North Carolina-Tennessee. Paleozoic granitic intrusives in the Piedmont province commonly are enriched in uranium, and some have potential for discovery of episyenite, pegmatite, authigenic, and contact metasomatic deposits. Triassic sedimentary basins are being explored for sandstone-type ore bodies, and are being considered for vein-type deposits related to the border faults, or to the basal unconformity. The potential of the Coastal Plain is almost unknown although there are good source rocks nearby, and substantial uranium is moving in the present hydrologic regime. Gorceixite occurrences in Aiken County, South Carolina, are of some interest. The Department of Energy is continuing to review areas and evaluate data generated under the National Uranium Resource Evaluation program.

Exploration and development of resources in the Atlantic margin are hampered by large metropolitan areas, high population density, higher priority uses of land, and the difficulty of negotiating leases. Environmental and antinuclear concerns have resulted in legislation restricting exploration and development in Vermont and New Jersey. Publich sentiment is divided on the issue of mining. Where these obstacles can be overcome, there are good opportunites and worthwhile prospects for further work.

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Petroleum Geology of Southern Appalachian Foreland Basin: Black Warrior Basin of Alabama

Because much of the petroleum contained in giant structure traps in the United States has been discovered, the petroleum resources of the future will be from complex petroleum traps involving structure, lithofacies distribution, and diagenetic alteration. The Black Warrior basin of northwestern Alabama is an excellent basin to prospect for combination petroleum traps; to date 35 petroleum fields have been discovered. The key to successful prospecting in this basin involves the delineation of local structure and determination of reservoir size, morphology, and quality. Mississippian sandstone reservoirs presently have the greatest petroleum potential, the Carter and Lewis sandstones being the most economic of these reservoirs. The Carter was deposited as part of a high-constructive, elongate to lobate delta which prograded from northwest to southeast into the basin. Specific deltaic environments identified include distributary channel and mouth bar, distal-bar, prodelta, and interdistributary bay. The Lewis accumulated as a series of elongate, northwest to southeast trending sand bodies on a shallow marine shelf. Specific environments identified include central-bar, interbar, and shelf.

Carter distributary-mouth bar and distal-bar lithofacies and Lewis central-bar lithofacies constitute the primary Mississippian reservoirs in the basin. These sandstones are usually fine grained, well sorted, subangular to subrounded quartzarenites or sublitharenites. Primary interparticulate porosity has been reduced through the development of quartz overgrowths and/or calcite cementation. Porosity is principally secondary and involves leaching of carbonate allochems, calcite cement, and/or matrix. The Carter prodelta and interdistributary-bay shales and the Lewis marine shales make excellent petroleum source rocks. These shales contain amorphous, algal, and herbaceous kerogen. The state of alteration of the kerogen indicates that the thermal history of the basin has been favorable for the generation and preservation of hydrocarbons. The hydrocarbon-trapping capabilities of these strata have been enhanced because of their association with normal faults.