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Petrology of Triassic-Jurassic Culpeper Group Conglomerates of Virginia

Most of the Culpeper Group conglomerates are exposed along the western margin of the Culpeper basin. These rocks are mostly muddy to sandy pebble conglomerates, and are interpreted as debris-flow deposits. Isopleths of maximum clast size show a decrease in grain size toward the east; this and paleocurrent data indicate that the conglomeratic materials were deposited on alluvial fans which spread eastward from highlands developed on the upthrown block west of the normal fault which borders the Culpeper basin on the west.

Pre-Triassic rock in the north-plunging Blue Ridge anticlinorium west of the basin was the source for gravel deposited on the fans. Spatial relations between the eastern limb of the anticlinorium and the border fault greatly influenced the composition of the gravels. The border fault generally has a more easterly strike than the pre-Triassic rock units. Pre-Triassic units intersect the fault so that progressively older rocks are exposed toward the south. From north to south the conglomerates contain clasts produced by erosion of progressively older rocks in the east-dipping limb of the anticlinorium.

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Late Ordovician Stratigraphy and Sedimentation in Northern Appalachian Basin

Recently drilled wells have led to a better understanding of the Upper Ordovician delta complex in the northern Appalachian basin. Regional cross sections and isolith maps show areas that should be favorable for natural gas exploration. The Upper Ordovician delta sequence preceded Medina deposition and was the first true geosynclinal deposition in the basin; in the western area, the formation is of marine origin and is principally sandstone. The area where the sandstones grade into shales and siltstones seems to be most favorable for future gas exploration. Past production has been influenced by regional tectonics as well as by stratigraphy and sedimentation. The occurrence and orientation of the fracture patterns are revealed by stream drainage patterns as well as by igneous intrusive patterns. Detailed studies of this part of the basin should be rewarding to venturesome explorers. Drilling depths are shallow (1,800 to 3,200 ft; 540 to 960 m) and the potential reservoir rocks are thick (more than 600 ft; 180 m). Reserves are similar to other low-permeability reservoirs, and have become economically attractive owing to recent gas price increases.

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Geology of Coal Deposits in Southeastern Saline County, Illinois

Saline County is located in southeastern Illinois. The geological boundaries of the area are the Cottage Grove fault on the north and the Shawneetown–Rough Creek fault on the south. The Pennsylvanian rocks are sandstone, shale, coal, and, locally, thin beds of limestone of the Caseyville, Tradewater, and Carbondale Groups. The coals are: Mt. Rorah and Wise Ridge of the Caseyville; Davis and Dekoven of the Tradewater; and the #2, #2A, #3, #4, #5, #5A, and #6 of the Carbondale. The Wise Ridge, Davis, Dekoven, #5, and #6 coals have been strip mined. The #5 and #6 have been deep mined. Extensive deep mining is planned in the near future for the Davis.

A drilling program has resulted in proving extensive Davis and Dekoven reserves for underground mining, and the #5 for both strip and underground mining.

The Pennsylvanian rocks are unconformably overlain by alluvium which reaches 120 ft (36 m) in thickness along the course of the Middle Fork of the Saline River.

Rock types, sedimentary structures, fossils, and electric-log characteristics indicate a succession of paludal, marine-lagoonal, nonmarine, and river-channel deposits for the Davis-Dekoven interval. Evidence of depositional environments for the rest of the section is not conclusive.

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Silurian-Devonian Embayment into Appalachia

Several Silurian and Devonian formations, traced along central Appalachian outcrop belts, undergo anomalous changes in lithology, thickness, and faunal content in the area of Pendleton County, West Virginia. Hematitic sandstones are replaced by nonred sandstones, other sandstones change to shales, shale formations thin and pinch out, and Catskill red beds are replaced by nonred clastics. These changes represent a move from nearshore to more offshore deposition within an embayment along the western shoreline of Appalachia.

The principal Silurian sandstones, the Tuscarora, Keefer, and Williamsport, all undergo facies changes in this area, becoming finer grained, argillaceous, and/or calcareous. Hematitic nearshore sandstones of the Rose Hill are replaced by nonred sandstones in the embayment. The Rochester and Rose Hill shales are thickest in, and largely confined to, the embayment; younger shales, the Big Mountain and Mandata, are replaced by sandstones south of the embayment. McKenzie shales contain more interbedded limestones in the embayment, and the fossiliferous middle Tonoloway Limestone contains a different fauna there than in adjacent areas. During Middle Devonian time, thicker, deeper water Needmore Shale beds in the area were flanked by shallower water facies of the Onesquethaw. The Mahantango Formation also is thickest in this area and thins abruptly to the south.

Throughout this time two provenances supplied detritus, one east of West Virginia's eastern panhandle and the second in central Virginia. The Pendleton embayment was situated between these two regions that occasionally prograded westward, accentuating the embayment. For the final Devonian regression these areas are referred to as the Fulton and Augusta lobes of the Catskill delta, separated by Grant bay.

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Devonian Shale Gas Production, Photolineaments, and Geology in Central Appalachian Basin of West Virginia

Remote-sensing methods involving photolineament mapping have been used for hydrocarbon prospecting with varying success. Much natural gas in the Appalachian basin is in formations of very low primary permeability; therefore production is from fractures. Natural fracture zones often appear as photolineaments on various types of remote-sensing images. In some parts of the basin, photolineaments have been demonstrated to be loci of improved production of natural gas. Photolineaments are also often indicative of surface and subsurface fractures and stress fields. A test was made of these relations for Devonian shale gas production in the central part of the Appalachian basin. Photolineaments were derived from satellite and aircraft images at a scale of 1:250,000; fracture data were measured on surface outcrops and in one core; and natural gas production data were open flows as given on drillers' logs. Fractures generally parallel nearby photolineaments, but the relation is not simple. Natural open flows tend to be lower on or near photolineaments than between them, whereas open flows of stimulated wells do not appear to be related to photolineaments. Such relations may be due to venting of gas through natural fractures, and the stimulated wells, having new fractures, release previously trapped gas. The disparity between results from this project and those of others may be due to several factors: the allochthonous sedimentary sheets present in the area of some other projects do not extend into the central part of the Appalachian basin; the lithologies differ in significant ways; and the methods used for mapping and the types of photolineaments differ.

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Profitable Shallow Appalachian Gas Reserves—Hard to Find or Easy to Miss?

Recent increases in gas price and subsequent drilling activity have resulted in a second look at old developed gas fields with marginal or submarginal production with the hope of improving the economics of gas development through reservoir analysis, drilling and completion methods, and the development of new or "hidden" reserves.

One of the deterrents to selling this type of prospect is the stigma of certain formation names and geographic areas in the mind of a prospective operator, his investor, or the prospect analyst.

Evaluation of oil and gas potential of development areas is enhanced significantly by a "look at the rocks." These studies of basic rock properties through examination of well samples and cores (porosity, permeability, grain density, pore size and distribution, pore-wall composition, and gas-fluid distribution) along with good electric logs are the dominant ingredients for effective reservoir analysis and completion designs.

With these tools one is equipped to evaluate (1) the significance of the rate of natural flow in air drilling, of drillstem tests in relation to gas or oil in place, (2) in-place reserves from electric logs, (3) economic feasibility for completing or plugging, and (4) completion designs.

Close supervision and planning were required to obtain good samples, test data, and electric logs. Poor electric logs result from rough well-bore conditions. In air-drilled holes "rough hole" and subsequent poor logs commonly are a result of "reducing well cost" by conserving casing through possible water zones. This cost-saving philosophy generally results in lost reserves in areas of low-permeability reservoirs.

Many areas of poor production are the result of cement and perforating problems. These problems can be recognized, avoided, and corrected with safeguard methods.

Development drilling is often complicated by lateral changes in gas-fluid ratios due to structural or stratigraphic separation and fossilized hydrodynamics. These problems are further complicated by inaccurate well elevations and subsequent poor structure maps.

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