sidered the most prospective are those where the Trenton and Knox carbonate rocks are encased by Upper Ordovician shales in the frontal and back imbricate zones where up to four thrust sheets may be superposed. Reservoirs are studied in relation to the depositional trends of Cambrian, Ordovician, Silurian, and Devonian fairways, diagenesis, and the enhancement of porosity and permeability by fracturing. The deformed belt is considered to be a gas province because of the maturing of hydrocarbons through burial and migration. Despite the low calorific gases in some areas, Silurian and Cambro-Ordovician objectives are above the eometamorphic threshold. The deformed belt has been explored sparsely and many large structures and deep objectives remain to be drilled.

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Diagenesis in Sandstone Reservoirs of Appalachian Basin

Diagenetic processes have had an important effect on porosity in the sandstones of the Appalachian basin. The Mt. Simon and Rose Run sandstones (Upper Cambrian and Lower Ordovician respectively) in the deep parts of the basin are generally of low porosity mainly because of quartz and carbonate cementation rather than compaction attending pressure solution or crushing from deformation. Locally, small voids have developed as a result of dolomitization of original calcite. These sandstones, at moderate depths in southeastern Ohio, are porous particularly in the highly feldspathic parts where cementation is incomplete and solution of feldspar is appreciable. Locally, argillaceous coatings inhibited cementation but promoted pressure solution.

The Tuscarora Sandstone (Lower Silurian) is generally well-cemented with quartz except in some of the very coarsest lenses. Small uncemented patches are present where argillaceous coatings or possible gas pockets prevented growth of secondary quartz. The lower part of the Williamsport (Newburg) Sandstone (Upper Silurian) has low porosity mainly because of dolomite filling pores. The upper part of the formation is quartzose with good porosity. Quartz cementation was retarded by argillaceous coatings on grains but locally anhydrite filled pores.

Porosity is developed best in the quartzose phases of the Oriskany Sandstone (Lower Devonian), especially in the western part of the Appalachian basin where cementation is less complete. Primary porosity decreases eastward as the amount of cement increases. Quartz and calcite cements were available both before and after folding. Widespread leaching of carbonate is not indicated. Secondary fracture porosity is important in deformed areas particularly in the well-cemented quartz sandstones which were more brittle. The Benson sand (Upper Devonian) is commonly of silt size and has very low porosity because of argillaceous material and secondary carbonate. Porosity is good in some of the coarser fractions (very fine-grained sand) where quartz cementation is incomplete and carbonate content is low. Locally, porosity was increased by partial solution of feldspar.

In the Berea Sandstone (Lower Mississippian) sericite and illite promoted pressure solution and led to considerable reduction in pore space in many areas. Porosity is relatively high, however, in the Cabin Creek and Gay-Fink trends where chlorite coatings were important in restricting quartz cementation. Solution of feldspar increased porosity in some places.

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Tully (Middle Devonian) to Queenston (Upper Ordovician) Correlations in Subsurface of Western Pennsylvania

Mechanical and sample-log correlations give the following results. The "Tully" of northwest Pennsylvania is a sequence of lenses at differing levels, confirming earlier ideas. The Delaware, Columbus, and Bois Blanc can be correlated eastward into Pennsylvania. The Bois Blanc is absent south and east of Warren County; southward, it grades into the Huntersville Chert. It contains a basal sandy zone locally unconformable on and commonly miscorrelated with the Oriskany. The Oriskany unconformably overlies rocks as old as Late Silurian around the basin margin, but into the basin is conformable on the upper Helderberg. The "no sand" area may be a clastic-starved carbonate facies of the Oriskany, rather than Helderberg. In southern Pennsylvania, a lower sandstone separate from the main Oriskany body may be Helderberg, previously miscorrelated. The Helderberg of northwest Pennsylvania is probably Manlius or older. The Salina Group in Pennsylvania is readily correlated northwestward; good regional markers are the Camillus Shale of New York and the C shale of Michigan. The top of the Salina G corresponds nearly to the top of the Tonoloway, the top of E to the top of the Wills Creek, and the Lockport equals part of the McKenzie. The upper McKenzie probably includes the Salina A. The Rochester Shale thins southeastward, whereas the Rose Hill thickens markedly. The Irondequoit Dolomite of the north is about in the position of the Keefer of the southeast. The Grimsby of the north and west is approximately equal to the Castanea and Tuscarora; the Whirlpool coalesces into the middle and possibly lower Tuscarora. Southeast of a line from northwest Somerset County through central Fayette County into West Virginia, the Tuscarora-Queenston unconformity is gone and the contact is a transition zone. Therefore, some of the basinward lower Tuscarora may be Ordovician.

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Central Broadtop Synclinorium and Its Implications in Appalachian Structure

The Broadtop synclinorium is a large regional synclinorium which extends from central Pennsylvania to western Virginia. Critical study of more than 125 mi of seismic reflection surveys, 22 wells, and surface maps shows that the synclinorium is broken into a series of folded and faulted structures which reflect a precise relation of basement movement to thin-skinned tectonics. This relation indicates that Taconic and older tension-induced features have a pronounced controlling effect on structures caused by later compression. Early tension faults localize features such as decollement ramping. This ramping in turn produces many large prominent first-order structural features in both the Valley and Ridge province and the Plateau province of the Appalachian basin, such as Wills Mountain anticline and the Allegheny front. The decollement ramping in turn induces formation of smaller second-order features such as the Whip Cove anticlines, the Whip Cove syncline, and other faults and folds within the Broadtop synclinorium.

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Lower Silurian "Clinton" Sandstone Geology and Petroleum Production in Eastern Ohio

Recent developments in the energy supply situation have intensified the search for and evaluation of new "Clinton" sandstone prospects throughout eastern Ohio.

Deposition of the "Clinton" sandstones was as distributary channels and barrier bars associated with deltas and as offshore bars along a westward transgressing shoreline. Trapping is controlled stratigraphically and structure serves only to aid in the separation of formation fluids within a reservoir. Minor local structure also helps to improve reservoir conditions through associated fracturing.

Clinton lithology is characterized by interbedded fine- to very fine-grained sandstone, siltstones, and shales. Porosity generally averages 8-9 percent and permeability less than 15 md. Because of these characteristics, the formation requires stimulation by hydraulic fracturing for commercial production to be achieved.