planktonic and larger foraminiferal zones are correlated, and datum planes are designated. These zones are correlated to Blow (1969) and van der Vlerk (1927) Letter Stage Classification for interregional correlation.

LASH, GARY G., State Univ. New York College at Fredonia, NY

Could Middle Ordovician Carbonate Shelf Depositional Patterns in Appalachian Orogene Indicate Collision Along an Irregular Continental Margin?

Analysis of Lower to Middle Ordovician carbonate successions and the conodonts they contain from Tennessee to New York show that (1) in the northern Great Valley, strike-parallel disconformable contacts occur between Lower and Middle Ordovician and within Middle Ordovician carbonate units, (2) apparent maximum extent of unconformities along tectonic promontories, and (3) relatively rapid subsidence and transgression at promontories. Diachronous early Paleozoic collisional events at an irregular continental margin might explain these observations. Initial Taconic collisions may have occurred at the Virginia promontory resulting in uplift and erosion of the Knox/Beekmantown shelf in Whiterockian time followed by rapid subsidence and transgression. Uplift and erosion, possibly related to continued convergence migrated southwest and at least as far northeast as Lexington, Virginia; beyond Lexington, shelf deposition continued relatively uninterrupted on the east side of the Great Valley. Collision at the New York Promontory could have produced the two pre-Blackriverian and pre-Rocklandian Middle Ordovician intervals of uplift and erosion on the Beekmantown shelf. These unconformities are greatest near Newburgh, New York, and decrease in magnitude northeastward and southwestward. West of Reading, Pennsylvania, in the Great Valley, carbonate shelf deposition remained virtually continuous. Thus between Reading and Lexington, in the Pennsylvania reentrant, continuous deposition during early Paleozoic collisions suggests that an irregular outline of the continental margin may have controlled patterns of sedimentation during collision tectonics.

LASH, GARY G., State Univ. New York College at Fredonia, NY

Sedimentation on a Passive Continental Margin (Late Cambrian-Early Ordovician), Central Appalachians

Environmental reconstruction of rocks of the Richmond slice, the tectonically highest slice at the eastern end of the Hamburg klippe in Pennsylvania, indicates that these rocks were deposited on a northwest-facing passive continental margin in Late Cambrian to Early Ordovician time. Detailed sedimentologic studies suggest that they can be divided into four main lithologic types, each bearing the imprint of one or more processes involved in its deposition. These include: (1) thin to thick-bedded, massive to graded, parallel and cross-laminated grainstone or calcarenite (high density turbidity currents; fluidized flows); (2) thin to medium-bedded, massive to structureless, graded and cross-laminated black lime mudstone and wackestone rhythmically interbedded with very thin to thin-bedded black limy mudstone and shale (low density turbidity currents and suspension); (3) thinly laminated graphitic black shale interlayered with irregular (lag) concentrations of fine sand and silt (redistribution of sediment by bottom currents); and (4) very thick-bedded, sand-matrix carbonate-clast conglomerate (gravelly high density turbidity currents and cohesive debris flows). The proposed depositional processes form a continuum of mechanisms that were in operation in the slope environment.

Regional stratigraphic studies suggest that the carbonate rocks of the Richmond slice were deposited on a depositional margin or ramp characterized by a gentle slope (1 to 2°) that decreased in gradient basinward. Only the lower slope portion of the continental margin has been preserved.

LAUGHREY, CHRISTOPHER D., Pennsylvania Geol. Survey, Pittsburgh, PA

Diagenesis and Secondary Porosity in Medina Reservoir Sandstones, Athens and Geneva Fields, Crawford County, Pennsylvania

Lower Silurian Medina Group reservoir rocks at Athens and Geneva fields in Crawford County, Pennsylvania, consist of very fine-, fine-, and medium-grained red and gray sandstones. The sandstones were deposited as bars and tidal deltas in a transitional marine setting. The sandstones produce gas from depths of 4,650 to 5,000 ft (1,395 to 1,500 m). The productive intervals are characterized by low average porosity and permeability (4.0% and <0.1 md) and low reserves.

Petrographic analyses show that primary porosity was extensively reduced during burial diagenesis by the precipitation of quartz and feldspar overgrowths. This stage of chemical compaction resulted in the reduction of intergranular porosity to irreducible lamellar porosity in the very fine to fine-grained intervals. These intervals also functioned as an extra stratal source of dissolved silica which precipitated as pore-filling cement in adjacent medium-grained intervals. Silica cementation was followed by the formation of authigenic clays, which diminished any remaining effective intergranular porosity.

Secondary porosity developed after deep burial. A variety of secondary sandstone pore textures are present in the Medina reservoirs at Athens and Geneva fields. Fracturing and grain shrinkage, coupled with remaining lamellar porosity, provided adequate passage for leaching brines formed during the generation of hydrocarbons in the adjacent shales. Additional secondary porosity formed through dissolution of sedimentary material and authigenic cement. Dissolution is evidenced by oversized and elongate pores, corroded grain margins, inhomogeneous packing, and microporosity within individual grains and cement. Some secondary porosity was subsequently reduced by the precipitation of carbonate and anhydrite cements concomitant with the entrapment of hydrocarbons. Secondary porosity was further reduced by grain alteration in the feldspathic intervals, as evidenced by a well-developed replacement fabric in these zones.

Adequate porosity for commercial production is found where the sandstones have the highest secondary porosities as determined by petrographic examination. Optimum reservoir development occurs where late-stage cementation by carbonate, anhydrite, and alteration product clays has not been extensive.

LYKE, WILLIAM L., Univ. North Carolina, Chapel Hill, NC (currently with Chevron U.S.A. Inc., New Orleans, LA)

Minnehaha Member of Upper Devonian Brallier and Scherr Formations of Central Appalachians

The Minnehaha member of the Upper Devonian Brallier and Scherr formations has been informally named, and its use as a time band within the marine strata of the Devonian Catskill delta complex of the central Appalachians is suggested. The coarse clastic bundle of the Minnehaha member can be identified in both outcrop and subsurface for approximately 150 mi (235 km) along the Allegheney Front from Bedford County, Pennsylvania, to Greenbrier County, West Virginia. The Minnehaha member is 20.9 to 98.4 ft (6.37 to 30.0 m) thick, consisting of interbedded very thinly to thickly bedded medium-gray siltstones and olive gray shales, with some grayish-red siltstones and shales.

The Minnehaha member was deposited by turbidity currents in generally unchanneled suprafan environments during the earliest Cohocton Stage. Three major, time persistent, depositional systems are recognized as having contributed to the Minnehaha member.