Witte, W.K., Kent, D.V., and Olsen, P.E., 1989, Pre- and post-folding magnetization of the Late Triassic Passaic Formation sediment in southeast Pennsylvania. Geological Society of America, Abstracts with Programs. v. 21, no. 2, p. 76-77.

№ 14863

STRATIGRAPHIC AND STRUCTURAL ASPECTS OF THE COASTAL PLAIN AQUIFERS, NORTH-CENTRAL CHARLES COUNTY, MARYLAND

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Facies changes, erosional truncation, and sediment overlap have resulted in the formation of a stratigraphically complex aquifer system in north-central Charles County, Maryland. A coarse, quartz-dominant, probably near-shore facies of the late Cretaceous Severn Formation (the Monmouth aquifer); fluviodeltaic channel sands in and a general eastward thickening of the late Cretaceous Magothy Formation (the Magothy aquifer); and stacked channel sands within the uppermost aquifer of the early to late Cretaceous Patapsco Formation (the St. Charles aquifer) form a thick sequence of interconnected sands (the Waldorf aquifer system). In western and southern Charles County, overlapping Paleocene sediments of the Brightseat and Aquia Formations limit the areal extent of the Waldorf aquifer system.

Stratigraphic correlations through north-central Charles County show the effects of an en echelon series of northeast-striking, high-angle reverse faults on the overlying formations and aquifers. Beds within the early Cretaceous Patuxent and Arundel Formations (undivided) and the lower part of the Patapsco Formation are probably offset. Folding is probably the dominant structural effect of faulting on the upper part of the Patapsco, the Magothy, Severn, and pre-Miocene Tertiary Formations. Bed offsets within these units, however, is not precluded by the available data.

The calibration of a digital ground-water flow model of aquifers in Charles County, Maryland, was improved by simulating reduced aquifer transmissivities along fault traces. Possible fault-related causes of reduced transmissivity include offset of sand beds, thinning of aquifers, and reduction of hydraulic conductivity by alteration of aquifer fabric.

№ 18495

OPEN SYSTEM, CONSTANT VOLUME DEVELOPMENT OF SLATY CLEAVAGE, AND STRAIN INDUCED REACTION AT LEHIGH GAP, PA.

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No important changes in the volume or composition of rocks occur across the mudstone to slate transition in the Martinsburg Fm at Lehigh Gap, Pa. Chemical analyses and specific gravity determinations of 74 samples of Martinsburg mudstones (ms) and sandstones (ss) across the strain gradient (Holeywell and Tullis, 1975) show a constancy of specific gravities and of ratios of Al_2O_3, TiO_2, FeO_T, MgO, MnO, Y, V, and Zr in 27 uncleaved ms indicating that the compositions of the muds at deposition were relatively uniform. The same constant values of these ratios in 21 increasingly highly strained rocks shows that all these components were inert during both diagenesis and the formation of slaty cleavage.

Using a minimum strain ms and ss and Al_2O_3 as references, calculated (Gresens, 1967) losses of CaO, Na_2O, Ba, and Sr from the outcrop correlate strongly with strain, and reflect an open system on the scale of > 100 m. These losses are apparently related to the strain induced dissolution of detrital plagioclase and illite. Analyses of ss-ms (quartzite-slate) pairs show that losses in SiO_2, Na_2O, and volume, and gains in K_2O and Ba in the ss (all proportional to strain) are balanced by opposite changes in the adjacent ms/slate. This documents a local mobility of SiO_2 on the scale of cm. However, the inertness of most major components over the 100 m outcrop (especially SiO_2) requires any fluid passing through the rocks to have been closely buffered by the quartz-albite-muscovite-chlorite assemblage. The volume change across this transition is zero (+/- 5%); the correlation of minor element chemistry and strain suggests that strain-induced reactions and not exotic fluids determined the changes in rock chemistry at this locality.

№ 28690

A MODEL FOR THE SEISMOTECTONICS OF THE APPALACHIANS BASED ON BRITTLE FRACTURE DOMAINS

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Lines of fracture observations across SW New England document a distinct break in character of minor fault characteristics along a line on the NE projection of the Ramapo Fault. This break is the NW edge of a 100-km wide domain of anomalous fracture characteristics. Within the zone in New England are a dominance of strike-slip slickensides on minor joint surfaces, the Mesozoic Newark and Hartford-Deerfield Basins, and most of the early Mesozoic basic dikes of the area. On a broader scale, a domain of NE-trending, 50 (+ or - 30) km long, topographic lineaments (Wise, Grady, and Salvini, 1988) coincides with the zone boundaries but extends from Alabama to Maine. This same lineament domain seems to correlate with the domain of regional-scale, later Paleozoic dextral faults. Most significantly, the lineament domain is remarkably similar to the Hadley and Devine (1974) seismotectonic domain map of the Appalachians.

The proposed model is based on recent COCORP and other data suggesting that most surface rocks of the Appalachian Piedmont have been thrust great distances westward over the now buried edge of cratonic North America. An irregular version of this edge was established in the Eocambrian with the opening of Iapetus. During the Paleozoic this ragged edge was massively overthrust and partially straightened by thrusts chipping off corners of the craton and by later Paleozoic regional strike-slip faulting. Early Mesozoic sinistral, transtensional strains were localized along the outboard portions of this deeply buried edge to produce the Mesozoic Basins and minor fault domains in the overlying sheet of Piedmont rocks. More recent to present-day WSW-directed ridge push forces reactivated this zone in a dextral sense. The result is shortening of the Haystack-Kitt Peak baseline, possible distortion of survey lines in the New York area, possible production of some of the topographic lineaments, and a concentration of seismic activity along the weakened and previously disturbed, deeply buried edge. In the interior, a second Eocambrian rift is being reactivated in the same way along the Mississippi-St-Lawrence line with cross linkage along the Champlain-Adirondack region. At locations where the localized tectonic creep is impeded by brittle rocks, cross-linked to the surface by younger plutons, or concentrated by larger faults in the overlying Piedmont sheet, elastic strains are concentrated and released along the deeply buried eastern edge of cratonic North America.

№ 28320

A FIELD LOCATION FOR STRUCTURAL ANALYSIS IN THE PENNSYLVANIA PIEDMONT

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The Piedmont Province in southeastern Pennsylvania is poorly exposed and structurally complex. As a result, outcrops where students can conduct field problems are rare. An exposure of the Peters Creek schist in the Coatesville 7.5 minute quadrangle shows an early ductile phase of progressive compressional deformation, followed by later more brittle strain.

Four generations of mesoscopic folds can be recognized. F1 folds are rare similar-style isoclines axial planar to the primary metamorphic foliation (S1). F2 folds comprise the dominant structures visible in the outcrop. These are gently plunging, near recumbent folds of similar to parallel style which verge to the northwest. An axial plane cleavage (S2) is variably developed. F3 folds are sharp-crested drag structures associated with shear surfaces (S3). These are most commonly developed on the limbs of F2 folds and show a consistent SE over NW sense of movement. Gently plunging upright kink folds (F4) cross cut all other structures.

Students can complete a structural analysis based on detailed mapping of the outcrop. Cross cutting relationships displayed at various locations around the exposure establish the relative age of each fold style. Analysis of fold element orientations suggests that F1 through F3 were approximately coaxial. These data can be used to construct a kinematic model. Thus, this exposure provides the opportunity to collect, analyze, and interpret data in this complex terrane.

The outcrop is located on private property controlled by the Brandywine Conservancy. Precise location and access can be obtained by contacting Christopher T. Herrman, P.O. Box 141, Chadds Ford, PA 19317, (215) 388-7601.

№ 28543

DEBRIS SOURCES OF MORPHOSEQUENCES DEPOSITED AT THE MARGIN OF THE KITTATINNY VALLEY LOBE DURING THE WOODFORDIAN DEGLACIATION OF SUSSEX COUNTY, NORTHERN NEW JERSEY

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The pebble lithology of morphosequences in the Kittatinny valley was studied to determine the provenance of the deposits and the mechanisms of debris transport to the margin of the Kittatinny valley lobe. Reconstructed ice-retreatal positions, morphology of the morphosequences, location of meltwater channels and paleocurrent indicators were also evaluated to further identify, and constrain, debris sources.

Morphosequences in the study area are ice-marginal lacustrine and lacustrine-fluvial sequences that were deposited in small glacial lakes which occupied sub-valleys within the main valley. Most of these deposits consist of sediment derived largely from debris sources in adjacent uplands (New Jersey Highlands, interfluves and foothills in the Kittatinny valley). Debris sources include reworked till and/or debris from the basal "dirty ice" zone.

Few morphosequences consist of sediment derived largely from sub-valley sources (till and debris at the base of the ice sheet). The lithologic content of these deposits is characterized by a mix of upland and sub-valley sourced debris.

In either case, debris from upland or sub-valley sources is transported to the margin of the ice sheet by subaerial meltwater streams and/or by meltwater through subglacial tunnels. Very little debris appears to have been delivered to the ice margin by "shear planes" or regelation bands.

№ 15111

PRE- AND POST-FOLDING MAGNETIZATIONS OF THE LATE TRIASSIC PASSAIC FORMATION SEDIMENTS IN SOUTHEAST PENNSYLVANIA

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Our previous studies of the middle Carnian to early Norian red beds of the Newark basin have shown their magnetization to consist of two components carried in hematite: a high temperature component, of reversed and normal polarity, unblocked above 660°C; and a low temperature normal polarity component isolated between 300°C and 600°C regarded as a remagnetization of Jurassic age. Because our earlier studies sampled homoclinal sections, it was not possible to determine whether either component was acquired before or after folding.

Recently, we have sampled five sites from both limbs of the Jacksonwald syncline (dips ~40°) in the lacustrine latest Triassic upper Passaic Formation. Two components of magnetization with demagnetization behavior similar to that observed in the earlier are present. The high temperature component was acquired before significant folding and exhibits both normal and reversed polarities. We belive this component to be syndepositional. The tilt corrected high temperature direction corresponds to a pole position at 57°N, 92E, A_{95} = 8° which agrees well with Late Triassic North American reference poles and is therefore consistent with syndepositional acquisition.

We interpret the uniformly normal polarity, low temperature component as a remagnetization. It fails a fold test indicating that folding was largely accomplished by the time the remagnetization was acquired. The age of the remagnetization is unfortunately problematic. The *in situ* remagnetization direction produces a pole at 80°N, 88°E, A_{95} = 14°, discordant with most accepted Jurassic reference poles and displaced northwardly from those poles. The remagnetization pole, although presently constrained by only 5 sites, is more similar to the *in situ*, rather than tilt-corrected, remagnetization pole from our earlier study. The *in situ* remagnetization pole from the earlier study is also displaced to high latitudes perhaps suggesting a high latitude North American apparent polar wander path loop in the Jurassic. Further definition of this portion of the apparent polar wander path will allow a closer estimate of the age of remagnetization and thus the age of folding.

№ 8714

THICKETING EVENTS - A KEY TO UNDERSTANDING THE ECOLOGY OF THE EDGECLIFF REEFS (MIDDLE DEVONIAN ONONDAGA FORMATION OF NEW YORK)

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Edgecliff reefs have been considered grossly similar in structure and growth pattern - micritic mounds of phaceloid rugosans surrounded by favositid dominated flanking carbonate sands - while at the same time being somewhat odd due to the near total lack of reef building stromatoporoids and algae. Recent investigations have documented a much different picture of these reefs. In the eastern portion of the state the classic pattern appears to hold true; but in the central portion of the state - both in the surface (Mt. Tom) and subsurface reefs (Thomas Corners' Core) - the pattern is more complex due to cyclical shifts between core growth and grainstone/packstone deposition at the top of the mound. The only western reef with an exposed "core" (LeRoy Bioherm), is now known to be a heavily eroded quiet water mound capped by crinoidal sands during the Edgecliff transgression. An understanding of the autecology of the phaceloid rugosans is the key to the development of these reefs. Under quiet water conditions these corals built mounds similar to the "Pioneer" or quiet water communities described from much larger Devonian reefs in western Canada; but under conditions of elevated turbulence their main contribution to mound growth consisted of "thicketing events". These events were areally widespread colonizations of crinoidal sand banks resulting in the formation of a single thicket, which although well established, did not lead to mound formation, instead being eventually overwhelmed by carbonate sands. These events are displayed at the LeRoy (2 events) and Youngman Quarry (4 events) reefs in the west, and at the North Coxsackie reef (2 events) in the east. The implication drawn from these "events" is that the rugosans were at the extreme edge of their adaptive range in terms of water energy conditions. Their importance and abundance was more a function of the unusual lack of true Devonian reef builders (stromatoporoids) than it was of their own reef building ability.

№ 8715

WATER TURBULENCE - THE CONTROLLING FACTOR IN COLONIAL RUGOSAN SUCCESSIONS WITHIN EDGECLIFF REEFS

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The Edgecliff Reefs (Middle Devonian Onondaga Formation) crop out across New York State from just south of Albany to Buffalo and then on into Ontario, and are found in the subsurface in New York and Pennsylvania. Developmental patterns of these reefs are diverse, ranging from simple, micritic phaceloid colonial rugosan mounds surrounded by favositid dominated crinoidal sand flanks, to large structures exhibiting cycles of rugosan growth and grainstone/packstone deposition. It is argued that the level of water turbulence controlled these patterns, with a successional sequence of Cladopora (a small branching tabulate), Acinophyllum, Cylindrophyllum, Cyathocylindrium, and favositid dominated crinoidal grainstone/packstone representing a gradient of increasing turbulence.

The developmental patterns of the reefs exposed in the Albany area confirm this hypothesis. Roberts Hill and Albrights Reefs are rooted in the basal wackestone (Cl) unit of the Edgecliff and display a shallowing upwards succession of rugosans (Acinophyllum - Cylindrophyllum - Cyathocylindrium) which follows the shift from wackestone to grainstone/packstone deposition in the area. The North Coxsackie Reef lies approximately 10 km. to the north of Roberts Hill. Here the Cl unit is absent (suggesting shallower water), and Cyathocylindrium directly colonized the crinoidal sands, forming a large thicket. Growth of this mound consisted of alternations between rugosan thickets and high energy crinoidal sand banks. A second mound - totally dominated by Acinophyllum and highly micritic - formed behind the first in a protected, back reef location. This evidence of faunally distinct high energy and low energy mounds, in conjunction with the data from Roberts Hill confirms that the level of water turbulence is the factor which controlled the observed rugosan succession in these reefs.

№ 28319

HERRING RUN: SUPERIMPOSED STRUCTURES OF THE BALTIMORE GNEISS EXPOSED IN A MODEL FIELD LABORATORY SETTING

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The Baltimore Gneiss is exposed in type section along a portion of Herring Run in Baltimore,, Maryland, offering a number of exposures ideal for the study of introductory and structural geology at all levels of expertise.

Introductory classes may take advantage of the many joints and joint surfaces, different exposed rock types, plunging isoclinal similar folds, convolute bedding, pegmatitic veins, and mineral formation. Structures and bedding orientations may be traced some length along the well-exposed streambed. Boudinage structures, overlapping fold styles, ductile shear zones, mylonitic gneiss, prominent rock lineations, preferred orientation of minerals, and good three-dimensional control on plunging folds make this an ideal location for advanced structural study. One large outcrop is exposed along the outer edge of a river meander, showing the development of a point bar sequence. A well-developed soil profile exists directly across the stream, demonstrating the weathering products of rock types that are immediately underneath and adjacent. Although located in an urban setting, close to the campus of Morgan State University, the outcrops are isolated from traffic by parking lots and overpasses.

№ 19540

SILCRETE BOULDERS NEAR WOODSTOWN IN SOUTHWESTERN NEW JERSEY

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Silcrete boulders have been found in the vicinity of Woodstown in southwestern New Jersey. The boulders litter knobs and slopes along the dissected scarp separating Delaware River Quaternary terraces from the upland surface underlain by Miocene sediments. The position of the boulders coincides with the distribution of the outcropping, middle Miocene, Grenloch Sand and Alloway Clay Members of the Kirkwood Formation.

The boulders are composed of indurated, mature quartz sand. The silcrete ranges from yellowish gray (5Y7/2) (Munsell, notation) to grayish orange (10 YR7/4) and has pinkish-gray (5YR8/1) to light-gray (N7) mottles. The silcrete displays pedogenic fabrics including autobreccia, prisms with clay skins, and root casts. Some boulder surfaces are mammillary, others have cusps, cavities, and faceted surfaces. Petrographic and scanning electron microscopic observations reveal remnant areas of authigenic pyrite surrounding detrital ilmenite. This association suggests a period of alteration of ilmenite under reducing conditions, followed by subsequent oxidation of pyrite. The constituent quartz grains have corroded and embayed grain boundaries suggesting a period of dissolution. Subsequently, micro-, macro-, and to a lesser extent cryptocrystalline quartz cements were precipitated. After precipitation of quartz cements, primary porosity and permeability were reduced, pore-water flow was restricted, and colloform structures formed in the interstitial voids.

During formation of the silcrete, the Grenloch Sand provided the host sediment and the kaolinization of the underlying Alloway Clay provided the primary source of silica. Within the shallow subsurface, several periods of dissolution and precipitation occurred resulted in the variable surface morphologies and petrofabrics. Our model suggests that the silcrete formed within a broad valley on low-gradient surfaces during warm tropical conditions. Such conditions prevailed during the lower to middle Pliocene, and, therefore, the silcrete is thought to be early to middle Pliocene in age.

№ 15687

THE TRANSFORMATION OF GEOLOGIST TO GEOSCIENTIST: EXPERIENCES IN THE ENVIRONMENTAL CONSULTING WORLD

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The ever changing nature of the environmental consulting world has required the typical geologist to evolve into a "jack-of-all-trades" geoscientist whose working realm involves many different non-geological facets. Today's adept geoscientist not only requires the knowledge of basic geology and associate geosciences, classic chemistry, physics, and math, but also requires some knowledge of biochemistry, biology, business administration, construction management, demography, ecology, economics, engineering (chemical, civil, environmental, mechanical, remedial, sanitary), health physics, industrial hygiene, law, materials science, marine studies, meteorology, public policy, toxicology, treatment technology, and zoology, just to name a few.

The consulting geoscientist, for example, is expected to locate and design a monitoring well, prepare a well construction specification and bid package, provide a 10-year discounted present worth analysis cost summary, procure the drilling contractor, develop a health and safety plan, supervise well installation, obtain the ground-water sample, provide a hydrogeologic evaluation, assess the raw laboratory data for quality assurance/quality control, evaluate the toxicity of chemical contaminants, perform a human health, flora and fauna endangerment assessment, design and evaluate the feasibility of a ground-water treatment system, write the final report, present the results at a public meeting, testify in court, and write the final invoice to the client.

The proficient geoscientist in the environmental field must be extremely flexible and open to learning and mastering many new sciences and subjects that often are extremely foreign to the traditional field of geology.