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GENESIS OF CARBONATE CONCRETIONS IN THE MIDDLE DEVONIAN UPPER LUDLOWVILLE FORMATION, ERIE COUNTY, NEW YORK

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ABSTRACT

Concretions in a zone about twelve feet below the Tichenor Limestone (uppermost member of the Ludlowville Formation) formed when just below a sediment-water interface. Their growth proceeded downward and laterally from an organic-rich center and was completed before they were more than five to ten feet below the sediment surface. Chemical products of organic decay, notably ammonia, diffused outward and reacted with connate waters, saturated with respect to calcite, raising the pH and precipitating calcite. First, these conclusions derive from the shape of the concretions, from their relation to the enclosing shales, and from their overall structure, particularly the position of pyritic fossil layers. Second, the relative volumes of soluble material (calcite) in the concretions are comparable with the relative pore volumes through the upper 10 feet of recent, fine-grained, clayey sediments. Finally, the postulated genetic sequence agrees with recent work on carbonate diagenesis. The formation of concretions was restricted to discrete zones by widespread combinations (of limited duration) of the rates of sedimentation, water circulation, and organic productivity, favorable to the rapid burial of much undecomposed organic material.

HYDROLOGY OF THE CAVERNOUS LIMESTONES OF SCHOHARIE & ALBANY COUNTIES, NEW YORK

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ABSTRACT

In a study conducted as part of a special topics course in Karst Hydrology, the author has investigated anomalous hydrologic conditions in the limestone uplands of the Allegheny Front where it intersects Albany and Schoharie Counties. A detailed study was made of the Upper Silurian and Lower Devonian carbonates and their water-bearing properties. The results of this study were combined with quantitative discharge measurements on springs and disappearing streams, and also with quantitative data from time of travel studies utilizing Rhodamine B, a fluorescent dye.

It was found that the thin-bedded, closely jointed Manlius Limestone (joint spacing one to five feet) formed cavernous openings acting as conduits for seasonally varying discharges. Protected by the massive, thickly bedded, overlying Coeymans Limestone, these conduits in the Manlius have been observed to discharge as much as 35 cubic feet per second at the Doc Shaul's Spring Gaging Site. The time of travel studies provided for injection of a dye into a disappearing stream and for measurement of the time required to detect this dye at the resurgence of the underground system. It was found that travel times varied from 40 hours for the two mile run from Thompson's Lake to Pitcher Farm Spring, to only four hours from Skull Cave Sinkhole to Beaverdam Springs. Moreover, travel times varied remarkably with the discharge through the cave system. A travel time of four hours through the Skull Cave System (approximately one mile in length) at discharge 15.1 cfs is to be contrasted with a 25 hour travel time through the same system at 4.1 cfs. Dye studies have also revealed the unusual hydrologic conditions caused by the blocking of pre-Pleistocene cave resurgences by glacial deposits. The result of the latter event has been the flooding of the entire lower portion of a Manlius cave system and the formation of the well-like Doc Shaul's Spring, which is fed by water under a hydrostatic head (very similar to artesian conditions). All results above are combined with data concerning known cavern systems in the area to construct a regional hydrologic picture.

THE ACFM PROJECTION — A POTENTIALLY USEFUL TOOL IN MINERAL EQUILIBRIUM STUDIES

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ABSTRACT

In granulite facies terranes, aluminum-, calcium-, iron-, and magnesium-bearing rocks frequently exhibit equilibrium assemblages containing more than three phases. The ACF triangular diagram in which iron and magnesium are added together in the "F" corner is thus inadequate to represent such assemblages.

By analogy with Thompson's (1957) graphic analysis of pelitic schists, the system SiO_2-Al_2O_3-CaO-FeO-MgO-H_2O may be reduced to an ACFM tetrahedron in the analysis of quartz-bearing rocks provided that H_2O is externally controlled as the humidity. The anorthite molecule is chosen as a point from which to project ACFM compositions onto the CFM plane, resulting in a map of those phases in equilibrium with quartz and anorthite for a particular range of pressure, temperature, and humidity.

Calculating rules for locating compositions on the projection are presented and discussed. Chemical analyses of four Adirondack rocks of gabbroic composition together with analyses of their constituent minerals are plotted on the ACFM projection. The variable Fe/Mg ratios of the rocks is clearly reflected in the Fe/Mg ratios of the phases present. The three-phase area for each assemblage is extremely small. Reasons for this anomaly are discussed and it is suggested that oxygen fugacity may exert a control over the bulk Fe/Mg ratio, shifting phase compositions to more magnesian values.

DISTRIBUTIONAL VARIATIONS OF A BRACKISH—WATER FAUNA IN A CHANGING ENVIRONMENT

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ABSTRACT

Investigation of the ecology and distribution of recent microfauna in the upper estuary of the Rappahannock River of Virginia revealed a facies boundary between the salt water foraminifera of the lower estuary and the fresh water thecamoebinids upstream corresponding to the 0.5 °/oo isohaline. With periods of low rainfall and discharge in the upper river valley, this isohaline shifted upstream, allowing foraminifera to migrate into marches which are normally fresh. Examination of a suite of 3-meter cores from Hunter Marsh near the estuary head (84 km or 52 nautical miles from the mouth) revealed a series of microfaunal population fluctuations at depth between percentages of foraminifera and thecamoebinids in 5-cm slice-samples.

Three explanations are suggested: (1) This data may be an "organic rain gauge" record of environmental changes, especially salinity, which have occurred in the estuary. As rainfall and discharge decrease, the foraminifera migrate upstream with the salt wedge. Return to more normal conditions freshens the marshes and kills the foraminifera; (2) The fluctuations may be a meaningless reflection of normal marsh variability; or (3) Sea level changes and sediment infilling may have modified the estuary. Carbon 14 datings from the base of two cores suggest an average rate of vertical marsh accretion and sea level rise of 0.130 cm per year.

More research is necessary before the most plausible explanation can be determined. If long term droughts are documented, they could help explain the Indian shell heaps of oysters along portions of the Hudson River which are now fresh water.

HEAVY MINERAL SIZE DISTRIBUTION IN SOME ERIE AND WARREN BEACH SANDS, WESTERN NEW YORK

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ABSTRACT

The principal objective of this study was to investigate textural characteristics of individual heavy minerals across beach zones of varying energy on the Lake Erie shore, western New York. A linear series of samples was collected from plunge point to dune. A similar series was also collected for comparative purposes from Lake Warren, a pre-Erie strandline.

Heavy minerals were separated from sand fractions, sieved at 1/2 Ø intervals, mounted, identified, counted, and statistically evaluated quantitatively by weight per cent.

Notable results show that (1) textural parameters of heavy minerals reflect higher environmental sensitivity than corresponding quartz sands, (2) abundance of heavy minerals generally increases inland across the beach, (3) garnet and zircon show particular promise as environmental discriminants, especially with respect to skewness and mean diameter, and (4) under subaqueous conditions, specific gravity chiefly governs the heavy mineral depositional regime whereas in aeolian transport, shape and lack of density combine their influence in controlling heavy mineral behavior.

STRUCTURE AND METAMORPHISM OF HURONIAN ROCKS AT ESPANOLA, ONTARIO

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ABSTRACT

During the Penokean orogeny, pelitic metasediments of the McKim (Nordic) Formation in the vicinity of Espanola, Ontario, suffered polyphase deformation and attendant metamorphism. Intrusion of Nippissing diabases and genesis of Sudbury-type breccia accompanied deformation.

Major folding was accompanied by development of a vertical axial-plane cleavage which strikes east-west. Lineations and minor fold-axes associated with this major deformation plunge both east and west reflecting the attitudes of major folds. Evidence of an earlier deformation is seen in thin-section where a fine foliation, delineated by flakes of sericite, and cross-cutting bedding, is cross-cut by the cleavage associated with major folding. A late phase of deformation produced strain-slip cleavage and minor folds.

Both the Nippissing diabases and the Sudbury-type breccias are transected by cleavages related to the major and late phases of deformation. Thus, in the Espanola area, diabase intrusion and formation of breccia preceded major folding.

Prior to and during the major phase of deformation, metamorphism reached its maximum intensity with the formation of chloritoid and garnet in the pelitic metasediments, and actinolite and hornblende in the diabases. No evidence was found for the presence of metamorphic zones of the type previously described in the Agnew Lake area; rather, the distribution of chloritoid and garnet was found to be controlled by lithology. Chloritoid-bearing members occur as mappable stratigraphic units.

ELECTRICAL RESISTIVITY INVESTIGATIONS OVER LIMESTONE CAVERNS IN EASTERN NEW YORK

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ABSTRACT

Electrical-resistivity prospecting techniques were employed with reasonable success in detecting cave passages by measurements made on the overlying ground surface. Passages were detected in at least nine out of 13 vertical profiles conducted over the cave passages. The results were compared with theoretical relationships expressing apparent resistivity as a function of electrode spacing, passage size and depth, and bedrock resistivity. Two of seven horizontal profiles succeeded in detecting a cave passage; these two profiles agreed well with the results of a model experiment.

The eastern New York field sites where this research was conducted feature an even surface topography underlain by cavernous limestones and dolomites which are flat-lying and electrically-homogeneous. The cavernous formations are overlain by a low-resistivity surface (weathered) layer which tends to screen out electrical effects arising from the cave passages below. Water-table levels had relatively little effect on the resistivity measurements, but large seasonal variations in surface-layer resistivity at one site are reflected by a marked difference in the success of cave detection.

THE PALEOMAGNETISM OF TWO DIABASE DYKES OF THE WHITEFISH FALLS AREA, ONTARIO

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ABSTRACT

Strangway (1961) stated that the stable remanent magnetism in diabase dykes was aligned in the plane of intrusion of the dyke due to demagnetization of the remanent component normal to the intrusive sheet. Fahrig et al. (1964) and Sopher (1963), from their studies of diabase dykes, do not support Strangway's proposition.

Eighteen samples were drilled across the width of a large NNW-striking diabase dyke, and thirteen samples along the length of a narrow dyke controlled by a jointing system striking in two predominant directions, N 110° E and N 150° E. The two dykes are assumed to be related to the Sudbury dykes which have been dated at 1285 m.y. (Fahrig et al.,1964).

The remanent magnetism of the samples was measured with an astatic magnetometer. The means of the declinations and inclinations of the remanent magnetism for the large and small dyke before demagnetization were determined as 105.5°, + 46.5° and 99.0°, + 20.5° respectively. The remanent vectors from the small dyke did not change in direction with any change in the strike of the dyke itself. The magnetism of both dykes is very homogeneous. The samples were demagnetized in A.C. fields of 50 oe., 100 oe., 150 oe., 200 oe. and 500 oe. r.m.s. From the paleomagnetic data it was concluded that the remanent magnetism of the two diabase dykes was not affected by their plane of intrusion. Paleomagnetic poles were determined to be 2.1° N, 17.8° W for the large dyke, and 1.1°N, 6.4° W for the small dyke.

AN OCCURRENCE OF THE HOLOTHUROID SCLERITE PROTOCAUDINA FROM THE DUNDEE LIMESTONE (LOWER MIDDLE DEVONIAN), SOUTHERN ONTARIO

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ABSTRACT

Only seven occurrences of holothuroid sclerites have been reported from rocks older than Carboniferous. Five species have been reported from the Ordovician (Weiss, 1954; Gutschick, 1954; Reso and Wegner, 1964). Four species have been reported from the Devonian (Prantl, 1947; Martin, 1952; Lehmann, 1958).

The Dundee Limestone is considered lower Middle Devonian and lies between the Hamilton Group and the underlying Detroit River Group. One well-preserved holothuroid sclerite, Protocaudina comparable to P. kansasensis (Hanna), has been found in acetic acid residue from the Dundee. Previously P. kansasensis (Hanna) has been reported only from Permian rocks. The one other reported occurrence of Protocaudina below the Carboniferous is P. hexagonaria Martin from the Upper Middle Devonian Cedar Valley Limestone of Iowa (Martin, 1952).

The fauna associated with the Dundee holothuroid material includes conodonts, ostracods, fish remains and sponge spicules.

POLLUTION VERSUS RECENT FORAMINIFERA IN THE HUDSON RIVER

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ABSTRACT

Four cores approximately 100 centimeters in length were taken of bottom sediments in the Haverstraw Bay - Tappan Zee Bay area of the Hudson River, New York, in the summer of 1964. The sediments contained in the cores are a moderately to poorly sorted mixture of clay, silt and sand of latest post-glacial age. The porportions of silt (62%), clay (32%), and sand (6%) are more or less constant throughout the length of each core. Quartz is the dominant sedimentary particle.

Two distinct assemblage zones are manifest in the foraminifera population of the four cores. The upper or Ammonia beccarii assemblage zone is dominated by Ammonia beccarii and comprises the upper thirty-five centimeters of each core. The lower or Elphidium clavatum assemblage zone comprises the lower sixty-five centimeters of each core. Species of Elphidium are not present in the A. beccarii assemblage zone, although A. beccarii is found in the E. clavatum assemblage zone.

Bulbous, frothy, solid pollutants occur in the upper thirty-five centimeters of each core. The pollutants, first introduced about forty or fifty years ago, are the solid remains of oil sludge pumped from ships in the Hudson River. The coincidence of the break between the Elphidium clavatum assemblage zone and the Ammonia beccarii assemblage zone and the appearance of pollutants, suggests that the pollution had either direct or indirect toxic effects on the species of Elphidium. Ammonia beccarii appears to have survived and flourished under conditions adverse to Elphidium.

STRATIGRAPHY AND STRUCTURE OF THE ROSENDALE AREA, ULSTER COUNTY, NEW YORK

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ABSTRACT

The region considered comprises all but the northwest quarter of an area bounded by latitudes 41° 49' and 41° 51' north and longitudes 74° 04' and 74° 06' west. Bedrock consists of a sequence of clastic and carbonate strata of middle (?) Ordovician, late Silurian, and early Devonian age.

The stratigraphic units observed in the area in descending order are:

FORMATIONS OR MEMBERS	APPROXIMATE THICKNESS IN FEET
Lower Devonian	
Esopus shale	(?)
Glenerie limestone	(?)
Connelly sandstone	5 - 10
Port Ewen shaley limestone	110
Alsen limestone	15
Becraft limestone	55
New Scotland shaley limestone	135
Kalkberg limestone	40
Coeymans (Ravena) limestone	20
Manlius (Thacher) limestone	45
Upper Silurian	
Whiteport dolomite	13
Glasco limestone	15
Rosendale Dolomite	20
Binnewater sandstone	30
High Falls shale	50
Shawangunk conglomerate	5 - 250 plus
Middle (?) Ordovician	
Martinsburg or Snake Hill shales and slates	Unknown (possibly several thousand)

The region has apparently been affected by two periods of deformation but deformation of Ordovician strata resulting from the Taconian orogeny is largely masked by subsequent Appalachian folding and faulting. The present structure commonly involves east-dipping thrust faults of moderate to low angle and open to close folds with infrequent overturning of limbs. Through much of the region major faults appear to remain separate and parallel to one another. On occasion they appear to truncate folds and to the northwest they seem to pass into folds or to die out. Foreshortening due to faulting and folding is estimated at a ratio of one to four. Folds tend to plunge to the northeast; in the northwest they tend to die out.

Understanding of structure in areas with close Silurian and Devonian stratigraphic control may be helpful in determining structure in adjacent areas underlain solely by Ordovician sediments with poor stratigraphic control.

PLEISTOCENE GEOLOGY OF SOUTH–CENTRAL AND SOUTHWESTERN VERMONT

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ABSTRACT

Southern Vermont shows strong evidence of glaciation by a continental ice sheet moving across the area from north 10° to north 40° west at its maximum. This direction of movement is inferred from striations, boulder distribution, and till fabric. As the ice retreated to a position north of the Massachusetts border, Glacial Lake Hoosic, with its water plane at 1100 feet and its outlet at Pittsfield, Massachusetts, was formed in the valley of the Hoosic River. Vestiges of this lake in Vermont are deltas and beach deposits in Stamford, southeast of Pownal, and on the south-west flank of Mount Anthony. Patches of lacustrine clay occur along the Hoosic River.

Lobes of ice existed in the Vermont Valley, Hudson Valley, and Connecticut Valley during deglaciation, during a readvance, or as a result of the ice of a separate glacial stage spreading into southern Vermont. The lobes in the Hudson and Vermont Valleys were contemporaneous as ice must have been present in New York to form a dam for high-level, ice-marginal lakes in the Vermont Valley. The temporal relation of these lobes to a possible Connecticut Valley lobe is not obvious.

Boulder trains, striations, till fabric and distinct, cross-valley kame and till moraines indicate that the ice lobe in the Vermont Valley retreated northward with regularly-spaced halts. Deglaciation by northward retreat of still-flowing ice is indicated in the Vermont Valley north of Bennington.

During the halt of the Vermont Valley lobe near Hale Mountain, a lake with the suggested name"Glacial Lake Shaftsbury" was formed with its water plane at about 900 feet. The dam for this lake was near Hoosic Falls, New York, and its outlet was around the south side of Potter Hill in New York.

Two sections on the east border of the Wilmington Quadrangle reveal two compact, sandy lodgement tills separated by five to fifteen feet of lacustrine sand. The lower till in both sections has a northwest fabric with a strong northerly component, and the upper has a strong fabric with distinct maxima at N30°W and N40°W. These are the only sections found in southern Vermont that indicate a possible record of multiple glaciation.

GEOCHEMISTRY OF A MEROMICTIC LAKE

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ABSTRACT

Numerous workers over a period of years have investigated the hydrology, geochemistry, biology, thermal structure and geologic history of Green and Round Lakes near Fayetteville, New York. Despite these investigations, a number of basic questions concerning these two mesomictic lakes remain unresolved.

A brief summary of data on thermal structure, biological observations and ideas advanced for the origin of these lakes is presented. The chemical and hydrologic balances is discussed in relation to our knowledge of chemical parameters.

(cont.)

Geochemistry of a Meromictic Lake (cont.)

Green Lake contains two well-defined water masses separated by a sharp gradient in salintiy. The deep mass is characterized by reducing conditions through which fall calcium carbonate precipitated in the surface mass and organic matter formed in the surface water. The sediments are characterized by alternating light and dark layers forming at the rate of about 0.1 mm/year. Dissolved total CO_2, PCO_2, C^{14}, and Sr^{90} were measured at various depths to determine the time constants of circulation and residence. The surface water has a mean residence time of about 2.5 years, and the deep water about 8 years. The increased total CO_2 and presence of H_2S in the deep mass are probably related to the action of sulfate-reducing bacteria located near the boundary layer between the water masses.

Major uncertainties include the amount and chemical character of ground water flowing into the deep water mass.

STRUCTURE OF THE NORTHERN HALF OF THE ROSSIE COMPLEX NORTHWEST ADIRONDACKS, NEW YORK

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ABSTRACT

The Rossie Complex is located in the Adirondack Lowlands at the intersection of the Hammond, Pope Mills, Natural Dam and Muskellunge Lake 7 1/2-minute quadrangles. Geologically the complex is bounded on the north by the Hyde School phacolith and on the south by the Payne Lake phacolith.

The stratigraphy of the northern part of the complex consists of nineteen concordant and three discordant units which have been folded into a series of broad open folds. The amplitudes of these folds increase from 2000 feet to about 4500 feet in a westerly direction. On the other hand, the wavelengths of the folds decrease from about 7000 feet to 3500 feet in the same direction. π - diagrams compiled for individual folds show a recurring pattern of double maxima representing the poles to planes of foliation of each limb of the fold. Separation of the individual folds into domains of different rock types suggests that the double maxima are a function of ductility differences between stratigraphic units of the folds. Great circles defined by the π - diagrams of the two rock-type domains are not well-developed but do suggest that the beta axes of the two domains are crossed. Double maxima would be developed in π - diagrams for domains of a fold which have different radii of curvature; however, in this case the great circles of the π -diagram would define the same beta axis. It is also thought that the double maxima developed by the poles to the planes of foliation might be a function of axial plane folding or refolding.

A fault with 3500 feet of right-lateral map separation is proposed for the western margin of the complex. Although there appears to be no direct evidence of faulting such as brecciation and/or mylonitization, there is ample indirect evidence of faulting:

(1) Disharmonic relationships of the fold which is inconsistent with the style of folding in the remainder of the complex;

(2) Fracture pattern developed in the nose of a tightly folded synform;

(3) Local steepening and re-orientation of the beta axis of the nose of the synform from S 2° W, 49° to S 12° W, 68°;

(4) Truncation of the splay in a gneiss unit by metagabbro, marble and pyritic gneiss units.

MINERAL — WATER EQUILIBRIUM, GREAT LAKES: ALUMINOSILICATES

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ABSTRACT

Sediments and interstitial water, cored from the Great Lakes, are analyzed mineralogically and chemically. Aluminosilicate - solution data are treated within thermodynamic equilibrium models.

Sediments from a granite basin lake (Onaping), and from the metasediment-situated North Channel (Lake Huron), provide "primary" source mineral types, i.e., feldspars, micas, and chlorite; sediments from limestone and shale terrane (Manitoulin Is., Lakes Erie and Ontario) are derived from "secondary", carbonate-clay mineral, sources.

The following observations are made:

(1) "Chlorite" and sodium feldspar are greatly undersaturated everywhere.

(2) Quartz is oversaturated in all interstitial waters.

(3) Amorphous silica - solution equilibrium fixes upper limits for dissolved silica concentration.

(4) Kaolinite is stable everywhere.

(5) Sodium montmorillonite - kaolinite equilibrium is approached closely in metasediment-derived systems. Calcium montmorillonite - kaolinite equilibrium is most closely achieved in granite and limestone sediments.

(6) Muscovite is generally unstable with respect to kaolinite. However, muscovite - kaolinite equilibrium apparently limits K^+/H^+ ratios to an upper value of ca. 10^4.

(7) Potassium feldspar - kaolinite equilibrium is very sensitive in a "push-pull" manner in the more "upstream" granite, metasediment, and limestone sediments (Lake Huron and northward).

(8) X-ray and optical studies confirm the presence of the minerals discussed.

(9) Aluminosilicate - solution equilibrium is prevalent in Great Lakes sediments. By virtue of this, the lake sediment - water systems control many aspects of their major ion chemistry.