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DEPOSITIONAL ENVIRONMENT OF ORDOVICIAN CATHEYS FORMATION, DADE COUNTY, GEORGIA

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ABSTRACT—A quarry was opened in the Middle Ordovician Catheys Formation in Lookout Valley, Dade Co., Georgia, southeast of US Route 11. The upper and lower formational boundaries of the Catheys are not exposed in this quarry. The stratigraphic sequence in this quarry is 28.0 m thick and contains 161 cycles of calcirudite with scoured bases transitionally overlain by green-gray shale. Calcirudite layers range in thickness from 1.0 cm to 1.1 m, and the green-gray shale from 0.5 to 14.0 cm. Branching bryozoans plus several species of brachiopods form most of the body fossil clasts in the calcirudites. Microscopic study of the calcirudites show them to range between packstone and grainstone in one classification and between biomicrite and biosparite in another classification. Crudely laminated micrite peloids and silt-sized quartz grains also are present in the calcirudites (on a microscale). Coarse-grained body fossil clasts of brachiopods, bryozoans, trilobites, and gastropods compose the main mass of these limestones. Matrix material includes micrite and finely crystalline calcite cement. Euhedral dolomite rhombs are present everywhere in the micrite matrix. It is tempting to interpret the calcirudites and green-gray shales as storm deposits (tempestites), but they may be merely "normal" Ordovician high-energy tidal deposits because, at that time, the moon exerted a much stronger "tidal pull" than at present.

A quarry was opened in the Ordovician Catheys Formation in Lookout Valley, 2 km southeast of Morganville, Dade Co., Georgia, southeast of US Route 11. The purpose of this study was to determine deposit morphology, sedimentary structures, and texture and composition of lithologic units in the Catheys in this quarry with the view of documenting regional variation of the Catheys in other exposures.

DESCRIPTION OF QUARRY

Stratigraphy—The cyclic, generally through-going limestone units of the Catheys Formation, exposed in this Lookout Valley quarry, consist largely of fragmented fossil shells of brachiopods and bryozoans. These fragmental limestone layers are considered to be limestone conglomerates known as calcirudites. The calcirudites have undulating bases which are described as scour structures. Green-gray shale units overlie the calcirudites in an abrupt, transitional way. Locally, the calcirudites are transitionally overlain by calcareous siltstones which are, in turn, overlain by green-gray shales.

Two benches have been formed by the quarrying process. Figure 1 shows three partial sections of the cyclic sequences of calcirudite, calcareous siltstone and green-gray shale. The section marked bottom is located at the base of the lower bench. The middle and top sections are found at the base and top of the upper bench. Neither the bottom nor the top of the Catheys is present in this quarry. Figure 2 shows the textural relationship between calcirudite and overlying laminated, rippled, and horizontally burrowed, calcareous siltstones.

There are 161 cycles of calcirudite (calcareous siltstone) and green-gray shale exposed in this quarry. The calcirudites range in thickness from 1.0 cm to 1.1 m, and the green-gray shale from 0.5 to 14.0 cm. The total thickness of the Catheys in this quarry is 28.0 m. According to Milici and Smith (1969), the Middle Ordovician Catheys Formation is the uppermost stratigraphic unit in the Nashville Group at the top of the Chickamauga Supergroup.

Paleontology—Branching bryozoans and several species of brachiopods form the major types of body fossil clasts (fragments) in these Catheys calcirudites. With the aid of Wilson (1948), tentative identification of three brachiopod species was made: *Rafinesquina alternata*; *Hertella occidentalis*; *Herbertella frankfortensis*.

Petrology—Thin-section study of these calcirudites show them to be grain-supported and range between packstone and grainstone in the Dunham (1962) classification or biomicrite and biosparite in the Folk (1954) classification. These coarse-grained, fragmental limestones show a crude lamination of lime mud (micrite), peloids (pellets), and silt-sized quartz grains. Coarse-grained body fossil clasts (fragments) of brachiopods, micrite-filled and coated bryozoans, trilobite carapaces, and vertically-coiled, micrite-filled gastropods make up the grain framework of these calcirudites. Matrix material includes micrite and finely crystalline calcite cement. Euhedral (well-formed crystals), zoned, dolomite rhombs are present everywhere in the micrite matrix material.

Structural Geology—This quarry in the Catheys is situated southeast (southeast limb) of a northeast-southwest trending anticlinal axis of the Lookout Valley Anticline. Within the quarry, on the highwall above the upper brench, there is a reverse fault (approximately 1.0-m displacement) which is overthrust to the northwest.

INTERPRETATION

Understanding the origin of the subtidal (formed on the sea floor) marine cyclic units in the Catheys is at present enigmatic. The cyclic, calcirudite and green-gray shale units (with local calcareous siltstone layers) have been interpreted by Rindsberg and Chowns (1986) as storm

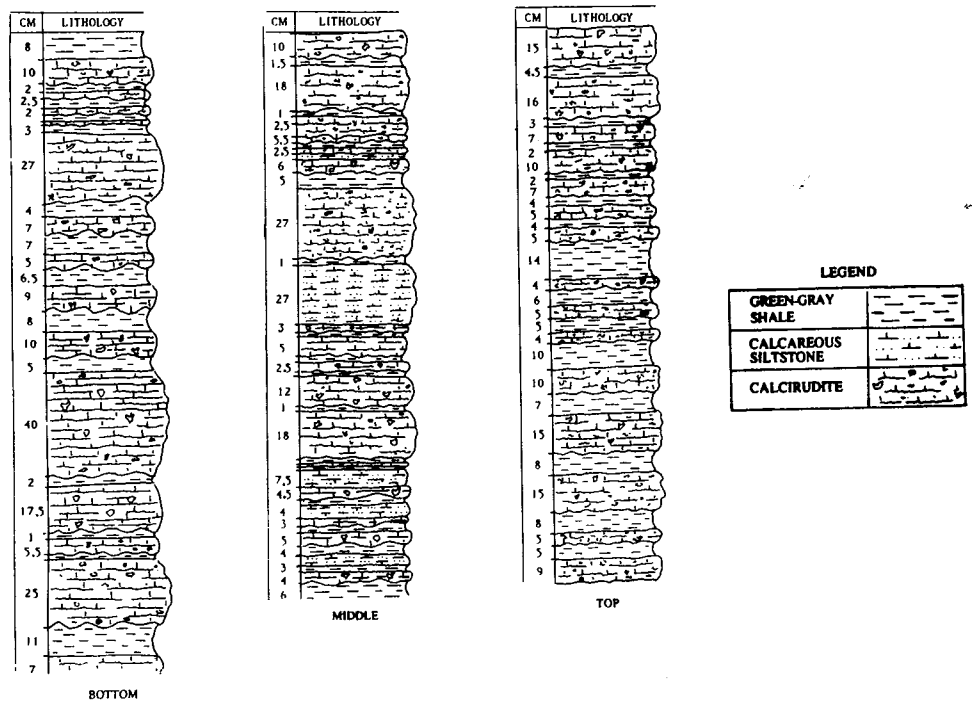

FIG. 1. Portions of measured section of Ordovician Catheys Formation exposed in a quarry in Lookout Valley, Dade Co., Georgia.

deposits (tempestites in more modern terms). Almost all of the bases of the calcirudite layers show a sedimentary structure known as "scours." This feature and the coarse-grained texture of the calcirudites indicate high energy, bottom currents that "cut into" (scoured) pre-existing soft, shallow sea-floor sediment. Other Catheys exposures at Green Gap (White Oak Mountain) along northbound Interstate-75, northeast of Chattanooga, and at Ringgold Gap in Taylor Ridge along southbound Interstate-75, south of Chattanooga, show similar structures and textures.

One of the problems of interpretation has to do with the question of where are the source areas on the shallow sea floor for in situ (in place) growth of bryozoans and brachiopods and other invertebrates. The whole area could not be made up of hundreds of cycles of storm deposits with no source area to obtain body fossils in growth position. Further, it is well known that the moon was closer to the earth during the early Paleozoic, in this case the Ordovician, and, therefore, tidal forces were much stronger at that time. Maybe, the calcirudites with scoured bases do not represent storm sequences but, rather, extra high-energy, "normal," high tidal deposits. However, this still does not answer the problem of fossil source area.

The green-gray shales doubtless represent suspension sedimentation (very low water energy conditions-calm water deposits) and may be considered as part of graded bed sequences with coarse-grained calcirudites on the bottom and fine-grained, green-gray shale on top. All of these may have formed at two different times (during and after a storm or during one depositional episode).

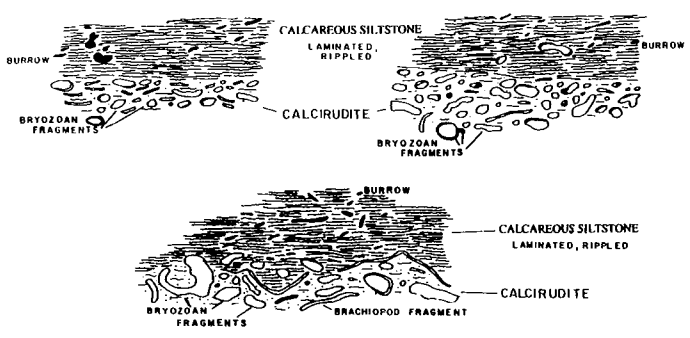

FIG. 2. Line drawing of slabbed sample face.

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