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ABSTRACT

More than 14 biohermal buildups have been recognized within the Pitkin Limestone (Mississippian-Chesterian) in eastern Washington and western Madison Counties, northwest Arkansas. These buildups resemble previously described algal mounds in upper Pennsylvanian strata of the Midcontinent region, but differ in their faunal and floral constituents.

The mounds are composed of calcilutite with variable amounts of spar and fossil allochemical grains. Associated flanking facies consist of mixed biosparite near the core, grading outward into oosparite. A few zones of shaly, poorly washed biomicrite containing rounded clasts bearing *Archimedes* fragments are interbedded with the flanking mixed biosparite facies. These clasts appear to be fragments of the mound facies, and suggest that the lithified mounds were attacked by wave activity.

The mounds developed from the entrapment of carbonate mud by cyanophytic algae (blue-green) and cryptostomous bryozoans. The mounds and flank facies appear to have originated in an area of relatively great turbulence, as indicated by oolite development, and thus were restricted in lateral expansion. Coincidence of lateral expansion of the mounds with deposition of an extensive mixed biosparite facies and an absence of oosparite development suggests less turbulent conditions.

INTRODUCTION

More than 14 lime mud mounds have been found in eastern Washington and western Madison Counties, northwest Arkansas (Fig. 1). This report describes the general lithic character and facies relationship of a particularly large group of closely spaced mounds in the NE¼, NW¼, Sec. 34, T15N, R28W near Durham, Arkansas. The largest single mound in this group (Fig. 2) has a lateral exposed width of 315 feet (95.7 meters) and a vertical dimension of 60 feet (18.2 meters). Examination of the Pitkin isopachous map indicates that mound deposition did not produce anomalous thicknesses of carbonate sedimentation (Fig. 1).

PETROGRAPHY

The mound cores at all 14 locations are similar megascopically. The core can be identified by its distinctive humpy and ropy weathered appearance, which contrasts with the smoother bedding surfaces of the other lithofacies of the Pitkin Limestone. Microscopically, according to R.L. Folk's classification, the mound core is a dark-gray, sparse biomicrite, with irregular spar-filled voids and rare allochemical debris (20% or less). Microscopic examination indicates that bryozoans are the dominant allochemical constituent, and crinozoans, bivalves, foraminifers, sponges, and oncoliths also are present.

The mounds show a marked variation in the abundance and diversity of the fauna in the lower five feet in comparison with the fauna found within the upper part. Sponges, brachiopods, spar-filled voids, and an abundance of fenestellid bryozoans characterize the lower part. Shale pods commonly are present here, and appear to be restricted to the lowest five feet of the mounds. The upper part of the mound core contains a limited abundance (10% or less) and diversity of allochemical debris. The typical mound rock is dark-gray fossiliferous micrite with minor fenestellid bryozoan fragments and spar-filled voids. The mound core facies is remarkably uniform both within and among Pitkin mounds. The only departures from the dense fossiliferous micrite are rare pockets of crinozoan fragments surrounded by mud and spar.

Five facies, recognized megascopically, are associated with the mound: oolitic calcarenite facies, mixed bioclastic-oolitic calcarenite, crinozoan bioclastic calcarenite, alternating shale and mixed bioclastic calcarenite, and a talus calcirudite. The oolitic calcarenite facies is typically massive, light-gray, well-sorted oosparite. A massive light-gray mixed calcarenite averaging 60% fragmental crinozoans, brachiopods, and bryozoans and 40% ooliths characterizes the mixed bioclastic-oolitic facies. Characterizing the crinozoan bioclastic facies is massive, medium-gray, poorly sorted crinozoan. Calcareous thinly bedded shale and irregular beds of light-gray mixed calcarenite compose the alternating shale and mixed bioclastic facies. The talus facies consists of irregular medium-gray calcirudite, with abundant large calcilutite clasts bearing eroded *Archimedes* fragments.

DEPOSITIONAL HISTORY

The lime mud composing the mounds probably was produced by chloraphytic (green) algae in a fashion similar to that by which recent lime mud was produced in Florida Bay (Stockman et al. 1967). Initial growth of algae began in the alternating shale and mixed biosparite

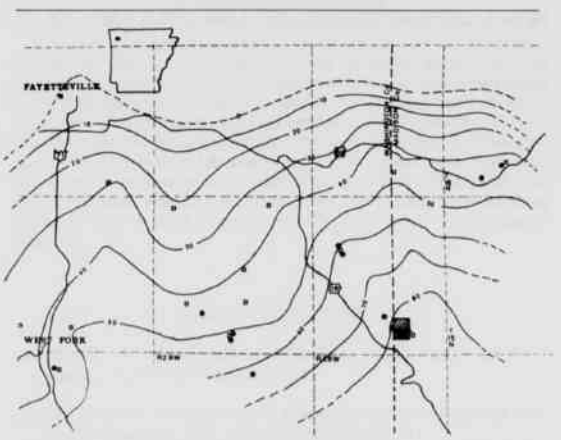

Figure 1. Organic mud mounds are indicated by closed circles; measured sections are indicated by open squares; study area is cross-hatched.

facies (Fig. 2). Cyanophytic (blue-green) algae acted as entrappers of the lime mud, producing a coherent, positive structure. In addition to cyanophytic algae, fenestellid bryozoans may have served to bind the lime mud, but this relationship is unclear.

After initial formation, the mound was in an area of relatively great turbulence as indicated by the development of abundant ooliths (Fig. 2). The turbulence restricted the lateral expansion of the mound by erosion of its margins. A talus facies containing nodules bearing *Archimedes* fragments interbedded with the flanking mixed bioclastic-oolitic facies suggests that the mounds were capable of being eroded. Conditions of decreased turbulence allowed lateral mound expansion. Such conditions possibly were produced by vigorous crinozoan growth, which acted as a baffle to wave energy, or to a slight increase in water depth. This interpretation is supported by coincidence of lateral expansion of the mounds with deposition of a thick mixed bioclastic facies (Fig. 2). Oolitic rock is not present at horizons of maximum lateral expansion (Fig. 2).

Many of the mounds were terminated by the development of oolitic shoals at the crest. This termination may be the result of the mound's inability to persist in great turbulence which would inhibit algal growth and cause erosion of the positive portions of the mounds.

CONCLUSIONS

Lime mud mounds were a common feature of upper Chesterian Pitkin deposition in northwest Arkansas. The lack of draped strata and the isopachous relations suggest that these mounds were of only low topographic relief during deposition. The presence of a talus facies indicates that the mounds were rigid and capable of resisting wave activity. Mound growth was related directly to algal mud production and to the energy level at the site of deposition.

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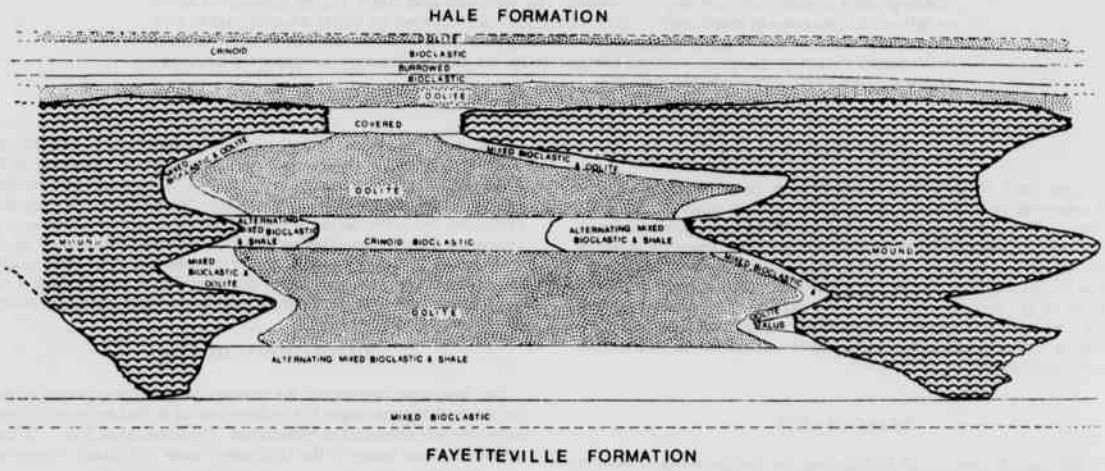

Figure 2. Lithofacies of organic mud mounds in NE¼, NW¼, Sec. 34, T15N, R28W. Vertical scale 1″ = 32′; horizontal scale 1″ = 84′.