

COVERT FACIES OF THE RED RIVER C LAMINATED MEMBER, NORTHERN WILLISTON BASIN

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The Red River C Laminated member (lower Lake Alma Member, Herald Formation) commonly has been viewed as little more than a shoaling upward, brining upward gradation from the subtidal marine Red River C Burrowed member (Yeoman Formation) below to the subtidal hypersaline C Anhydrite member (upper Lake Alma) above. Poorly defined "transitional zones" occur where C Laminated strata locally change facies from "typical" laminated mudstone. One such anomaly was described by Pratt *et al.* (1996) as a stromatoporoid rudstone and thrombolite boundstone reef. Cores of this member and associated Upper Ordovician strata from 108 wells were studied to demonstrate that little known shallow subtidal, intertidal and supratidal environments were widespread throughout the northern Williston Basin during accumulation of the lower Red River C Laminated member.

Bedding, textures and fossil assemblages of the underlying Red River C Burrowed member, which includes abundant *Thalassinoides*, echinoderms and brachiopods in wackestone, are distinct rather than transitional from the C Laminated member. The lower C Laminated is composed of 1) laminated mudstone dominated by *Planolites* and *Chondrites* burrows and 2) current-bedded grainstones, floatstones and boundstones characterized by abundant peloids, mud and thrombolite intraclasts, irregular ooids, ostracods, and digitate thrombolites and stromatolites. Echinoderms, brachiopods, laminar stromatoporoids, bryozoans, bivalves and gastropods are lesser constituents. The upper half of the C Laminated member consists of laminated mudstone containing sparse burrows and thin interbeds of grainstone composed of peloids, intraclasts or ooids and rare ostracods and echinoderms.

Subtidal marine facies of the Red River C Laminated member, including laminated, burrowed mudstone and skeletal wackestone, are most common in the southeastern and western parts of the study area. Shallow subtidal and intertidal to intermittently supratidal facies of lower C Laminated strata feature laminated mudstone, and grainstone variously composed of intraclasts, peloids, coated grains and ooids. These facies are believed to represent tidal mud flats of diverse dimensions, longevity and preservation. Apparently the tidal muds were bounded in places by stromatoporoid banks and thrombolite mounds with intervening grainstone tidal channels or by peloid sand shoals and beaches, and enclosed saline pools colonized by microbial assemblages that produced erect thrombolites and stromatolites. Low energy oolite shoals dominated the northeastern part of the area. Frequent, short-term subaerial exposure is inferred from the common presence of eroded hardgrounds and by the alternation of bleached, bored and desiccated mud laminae with unbleached, intraclastic laminae. The presence of many small oncolite-coated orthocone nautiloids in peloid grainstone, in settings least suited for these creatures, further supports local subaerial emergence and the proposal that the lower C Laminated member represents the maximum sea-level lowstand for the Red River C cycle of deposition.

REFERENCE CITED

- Pratt, B.R., L.M. Bernstein, A.K. Kendall and F.M. Haidl, 1996, Occurrence of reefal facies in Red River strata (Upper Ordovician), subsurface Saskatchewan, in Summary of Investigations 1996, Saskatchewan Geological Survey, Saskatchewan Energy and Mines, Miscellaneous Report 96-4, p. 147-152.