SELECTED EXAMPLES OF PROTEROZOIC TO DEVONIAN CARBONATES OF ANWR, HOLITNA BASIN AND KANDIK BASIN, ALASKA

James G. Clough
Alaska Div. of Geological and Geophysical Surveys
&
University of Alaska Fairbanks
Dept. of Geology and Geophysics

Examples of Proterozoic to Devonian carbonates from three regions of Alaska will be presented discussing lithofacies and depositional environments. Related modern settings will be considered and the significance of facies relationships will be emphasized throughout.

1. KATAKTURUK DOLOMITE, ANWR

The Katakturuk Dolomite is a 2000 m thick sequence of basinal to supratidal carbonates which have been exposed by Mesozoic and Cenozoic uplift in structural duplexes and thrust sheets forming the Sadlerochit and Shublik Mountains and Kekiktat Mountain in the Arctic National Wildlife Refuge, northeastern Brooks Range, Alaska. New age revisions of the unconformably overlying Nanook Limestone (Cambrian, Ordovician and Devonian) suggest that the Katakturuk Dolomite is Proterozoic in age.

The basal Katakturuk Dolomite consists of a shallow water pisolitic and banded silicified sequence. This is overlain by carbonate debris flow breccias and turbidites deposited in a deep-water slope to basin-plain setting. These grade upsection into shallow water, cross-bedded oolitic and algal grainstone, with intermittent zones of subtidal stromatolites, and culminate in intertidal to supratidal facies containing numerous stromatolite forms, cryptalgal laminate, mudcracks, microspeleothems, and collapse breccias.

1. NANOOK LIMESTONE, ANWR

The basal Nanook Limestone (Cambrian or older) consists of moderately deep-water, interbedded, burrowed dolomite and calcareous shale dolomite turbidites deposited in a slope to near slope environment. Unfossiliferous limestone and vuggy dolomite in the middle part of the Nanook represent mostly shallow water deposition. Depositional environments of the upper Nanook Limestone (Late Cambrian, Ordovician, and late Early Devonian) were shallow subtidal to intertidal. These beds consist of peloidal and oolitic limestone and dolomite with locally abundant trilobite and gastropod horizons. Calcareous algae are common in the Ordovician portion. Lower Devonian limestone contains abundant fauna and rests unconformably on the Upper Ordovician strata.

2. HOLITNA BASIN, SW Alaska

A Silurian-Devonian buildup of algal reef mounds is exposed in the White Mountain to Holitna Basin area of southwestern Alaska. The algal reef mound complex is part of the Middle Cambrian through Devonian (Frasnian) carbonate Holitna Group and lie within a package of Middle Cambrian to Triassic sedimentary rocks which are, in part, disconformably overlain by Cretaceous clastic rocks. The buildup of algal reef mounds is up to 500 m-thick and over 1 km wide and it forms an outcrop belt over 95 km long, however it is known to extend at least several hundred kilometers to the northeast. The algal buildup was constructed on a southeastern facing carbonate ramp or distally steepened ramp with the algal reef mounds building sufficient relief with time into a barrier reef mound complex. The

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complex was separated from the platform interior tidal flats, located to the northwest, by a broad (kilometers-wide) lagoonal environment. Basinward of the algal buildups are deposits of carbonate grainstone to conglomerate composed of algal reef detritus deposited as debris flows in a slope environment.

The algal reef mound complex is composed of three genetically-linked sedimentary facies which together represent one complete shallowing upward cycle. The shallowing upward cycle was repeated numerous times during construction of the algal buildup. While outcrop exposure is excellent it is often difficult to differentiate these facies in the field. The complex rests conformably on basinal dark gray lime mudstone and shale.

The lowermost facies of each cycle consists of thrombolite mud mounds up to 20 m-thick which often coalesce laterally. The thrombolitic mudstone has a vermiform microstructure with abundant elongate and irregular fenestrae. This facies formed in a subtidal environment, probably by unlaminated stromatolitic sediment binding and submarine cementation.

The thrombolitic mudstone facies grades upward into the second facies, a layered stromatolitic bound mudstone to wackestone. This facies is composed of small columnar stromatolites, undulose to oncolitic stromatolite masses, and ramose algal wackestone.

The third and uppermost facies of a complete shallowing upward cycle consists of cryptalgal laminated peloidal mudstone to wackestone with laminoid fenestrae. This facies represents deposition in the intertidal to supratidal zone and is similar to the platform interior's coeval tidal flat facies. This facies is not as prevalent as the lower two facies as not all shallowing upward cycles within the buildup culminated in the intertidal/supratidal depositional environment.

3. KANDIK BASIN, E-CENTRAL Alaska

A shelf-edge coral-stromatoporoid reef complex occurs on the southwestern margin of the Pragian-Emsian carbonate platform partially exposed in the western Ogilvie Mountains of the Kandik Basin, east-central Alaska. The complex occurs in outcrops of the Ogilvie Formation located north of the Tintina Fault and Yukon River along the southwestern edge of the Yukon Stable Block, an area of carbonate and shale deposition from Precambrian through early Mesozoic time. The reef complex consists of an initial Renalcis algal boundstone core facies overlain by a bioherm containing abundant in situ hemispherical colonial corals and tabular to lamellar stromatoporoids. The Renalcis boundstone overlies cross-bedded pelletal and encrinoidal grainstone and represents substrate stabilization of actively shifting sand shoals prior to skeletal metazoan colonization.

The coral-stromatoporoid bioherm is unbedded to massive bedded with reef framework composed of from 50 to 70 percent hemispherical colonial framestone and lesser quantities of tabular and lamellar stromatoporoids. In place and overturned corals are commonly capped by stromatoporoid framestone to bindstone especially near the top of the reef complex. Reef framework voids are filled with angular to rounded fine- to coarse-grained skeletal sediment which includes coral, stromatoporoid, pelmatozoan, and molluscan shell debris. Penecontemporaneous with reef growth were shelf margin crinoid thickets in interreef areas.

Based on petrologic and paleontologic studies of Lower Devonian (Pragian to Emsian) rocks collected from ten measured stratigraphic sections, seven standard carbonate facies belts are recognized. The coeval limestone and shale member of the McCann Hill Chert represents basin and deep shelf margin facies whereas the Ogilvie Formation represents foreslope, reef, winnowed shelf edge sand, lagoon, and open marine shelf facies.