SEDIMENTARY FACIES OF THE TORONTO LIMESTONE, LOWER LIMESTONE MEMBER OF THE OREAD MEGACYCLOTHEM (VIRGILIAN) OF KANSAS

by

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ABSTRACT

The Toronto Limestone is the lower limestone member of the Oread Megacyclothem. It averages about 10 feet in thickness and is exposed from northern Oklahoma, where it undergoes facies change to shale, across Kansas to northwestern Missouri and is present at the surface in the Platte River Valley of Nebraska.

The purpose of the study was to determine the sedimentary facies and to interpret environments of deposition by a quantitative approach with special emphasis on the constituent composition of the limestone. Field stratigraphic studies were undertaken at 54 localities and detailed laboratory studies were performed on samples collected from them. The volumetric abundances of 19 skeletal and 4 non-skeletal grain types were determined quantitatively by point-count analyses. Factor analysis of the accumulated data, supplemented with observations on the megafauna and field study, were used in delineating 6 facies. From southern Kansas to northwestern Missouri, the lower half of the Toronto is a skeletal mud facies -- characterized by the presence of diverse skeletal grain types. This facies grades northward (in Nebraska) and southward (in southern Kansas) into a brachiopod facies - typified by an abundance of brachiopods, many of them complete specimens. In southern Kansas, the Toronto Limestone interfingers with and is replaced by a fossiliferous terrigenous mud (shale) facies-- characterized by myalinid-rich, brachiopod-rich, and fusulinid-rich zones. In northern and central Kansas, a facies characterized by the presence of fenestrate bryozoans and crinoid segments, the fenestrate bryozoan-echinoderm grain facies, is developed near the top of the limestone. A lime mud facies, characterized by the presence of a molluscan fauna and containing intraclasts, is developed at the top of the Toronto Limestone in Nebraska, northwestern Missouri, and in northern Kansas. In southern Kansas, a molluscan-"Cryptozoon" subfacies of the skeletal mud facies is developed in the upper part of the limestone. An Osagia grain facies, an accumulation of algal-coated skeletal grains, is locally developed at the top of the Toronto in south central Kansas.

The Toronto Limestone was deposited during a single advance and retreat of the sea with deltaic deposition taking place along shore in northern Oklahoma and possibly in Nebraska while lime was being deposited offshore in Kansas. The factors of primary importance in facies differentiation are interpreted to have been (1) rate of terrigenous sediment influx, (2) nutrient element supply; (3) salinity; and (4) turbulence. From the deltaic fringe area to the farthest offshore and most marine conditions the respective facies tracts were (1) fossiliferous terrigenous mud, (2) brachiopod facies, (3) skeletal mud

facies, and (4) echinoderm-fenestrate bryozoan grain facies. The lime mud facies was a product of mud flat deposition mainly during the regressive phase.

At several places along the outcrop between northern Oklahoma and northwestern Missouri, the Toronto Limestone was channeled by streams prior to deposition of the Leavenworth Limestone which is continuous across the region. The Leavenworth and the overlying black Heebner Shale show greater continuity of facies than the Toronto Limestone. The lower part of the Oread Megacyclothem (Wathena Shale, Toronto Limestone, Snyderville Shale, Leavenworth Limestone, Heebner Shale, and Plattsmouth Limestone) are explained by two eustatic sealevel cycles. The Wathena and Toronto were deposited during an intermediate rise of sea-level, the Snyderville accumulated during the regression, and the Leavenworth, Heebner and Plattsmouth were products of a greater rise of sealevel.