

Calcrete and karst of the Devonian Winnipegosis Carbonate Mounds, Subsurface of South-central Saskatchewan, Canada

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ABSTRACT

The subaerial diagenetic features in Middle Devonian Winnipegosis mounds include dolomitised calcrete (dolocrete) and paleokarst. Dolocrete successions are widespread in the uppermost portions of mounds and commonly contain multiple profiles. The individual dolocrete profiles vary from a few centimeters to a few meters in thickness and generally consist of 2 to 5 horizons: in descending order, laminar crust, platy-massive, pisolitic-nodular, lithoclast-breccia, chalky-powdery and transitional horizons. The dolomitised calcrete is interpreted as pedogenic calcrete and was formed by diagenetic alternation of host carbonate sediments in vadose zones during subaerial exposure.

Paleokarst of the Winnipegosis is characterized by extensive solution features, non-tectonic fractures and cavity sediments and speleothems. Caves and cavities filled with anhydrite were developed in both dolocrete successions and underlying host carbonate rocks. High porous "Swiss cheese" fabric occurs as an open, sponge-like pore network in the middle parts of the mounds. The caves, cavities and "Swiss-cheese" fabric are interpreted to have formed in freshwater-saltwater mixing zones and/or occurred at or just below the water tables in the phreatic zones.

The mound growth was interrupted by at least three periods of subaerial exposure, as represented by three dolocrete profiles in top parts of some mounds. The development of caves and cavities at the various levels in the mounds are interpreted to be related to formation of vadose, phreatic freshwater and mixing zones at different depths corresponding to relative changes in sea-level in the Elk Point Basin.