

Hyperspectral Scan Imagery and XRD Identification of Carnallite as a Potash Source in Brines Associated with Ordovician and Silurian Formations in the Williston Basin, North Dakota

M. A. Vasquez¹, Stephan Nordeng¹, and Lionel Fonteneau²

¹University of North Dakota

²Corescan Pty Ltd

In the past decade the demand for potash have been steadily increasing. Potassium or potash is a major constituent of most fertilizers on the market. Potassium deposits are found in the form of chemical or mineral compounds such as chlorides and sulfates. The geological environments associated with potash minerals are typically evaporites where minerals such as Sylvite (KCl); Carnallite (KCl MgCl₂ 6H₂O); Kainite (KCl MgSO₄ 3H₂O); Halite (NaCl) precipitate from evapoconcentrated brines. The Williston Basin in North Dakota contains several thick stratigraphic sections associated with evaporite and sabkha environments with the common occurrence of anhydrite, and rarely sylvite where evaporitic minerals have been identified.

A review of hyperspectral core scanning (Corescan© Hyperspectral Core Imager, HCI 3.2) of some 9800' of cores from the North Dakota portion of the Williston Basin found reflectance signatures that are consistent with the presence of carnallite KCl MgCl₂ 6H₂O. Carnallite appears to be present as crusts lining pore space exposed in slabbed cores of laminated dolostones associated with nodular anhydrite. Carnallite with this association was found in several cores of the Red River (Ordovician) and Birdbear (Devonian) formations. Evaporation of interstitial pore filling brines appears to be the most likely source of the cations that precipitate as carnallite. XRD and ICP-MS of samples from cores with hyperspectral signatures indicating carnallite are consistent with this interpretation. To the authors knowledge, this is the first report of carnallite in the Paleozoic section of the Williston Basin in North Dakota. These results indicate that some brines associated with these formations may be a potential source of potash or dissolved potassium.

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