Charles A Salt Extent and Thickness

Williston Basin, North Dakota

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Summary

A total of 2,579 wells were examined to determine the lateral extent and cumulative (net) thickness of the Charles A salt (Charles Formation, Madison Group), of which 1,768 contained Charles A salt as identified in well logs. As mapped the Charles A salt covers ~5.8 million acres (~23.6 billion m^2) of North Dakota's subsurface (fig. 1). Net thicknesses vary dramatically (fig. 2) and range from 0 to 166 ft (0 to 51 m). Volumetrically, there is over 528 million acre-feet (652 million m^3) of Charles A salt in North Dakota. Subsea depths range between -4,366' SSTVD (6,642' TVD) to -6,932' SSTVD (9,461' TVD). Isopach map, well data, associated shapefiles, subsea and TVD structure maps are included.

Methodology

Wells with digital logs containing gamma ray (GR), bulk density (RHOB), and deep resistivity (RESD) curves were examined and interpreted to determine the lateral extent and net vertical thickness of the Charles A salt. Net salt thickness from digital logs was calculated using a combined cutoff methodology with RHOB (< 2.3 g/cm^3) and RESD (> 200 ohms). All calculated net salt thicknesses were manually checked to remove erroneous data. Isopach and structure maps were subsequently created using these data.

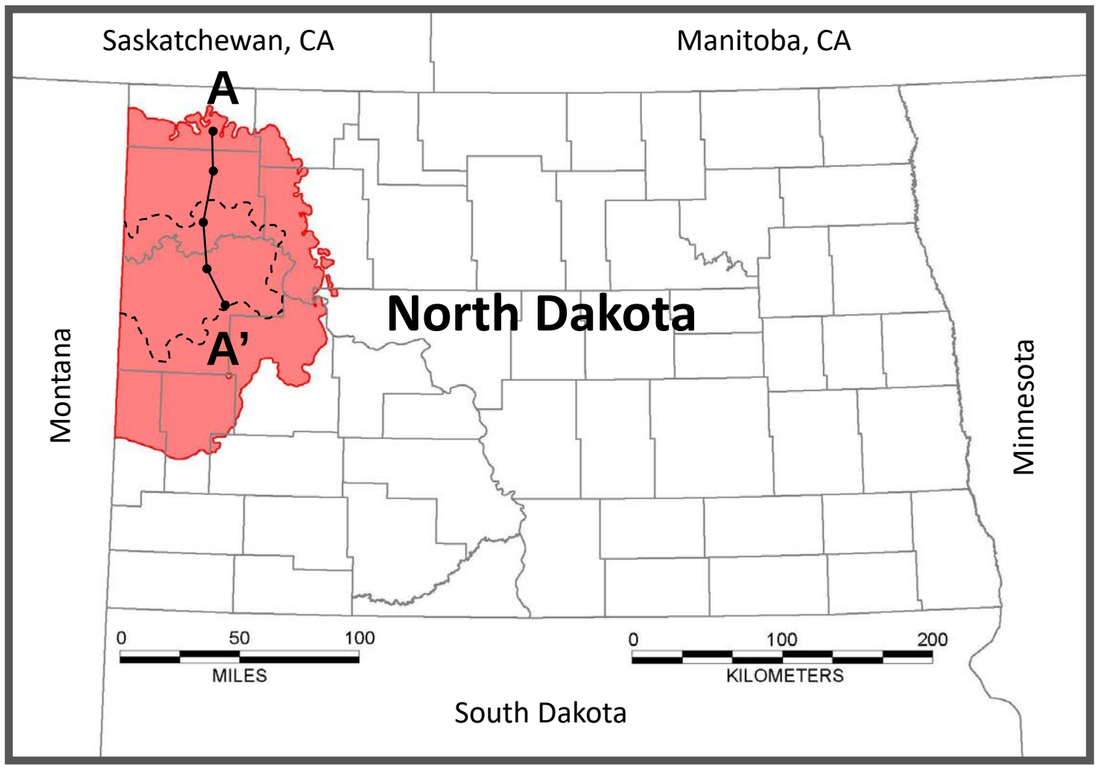
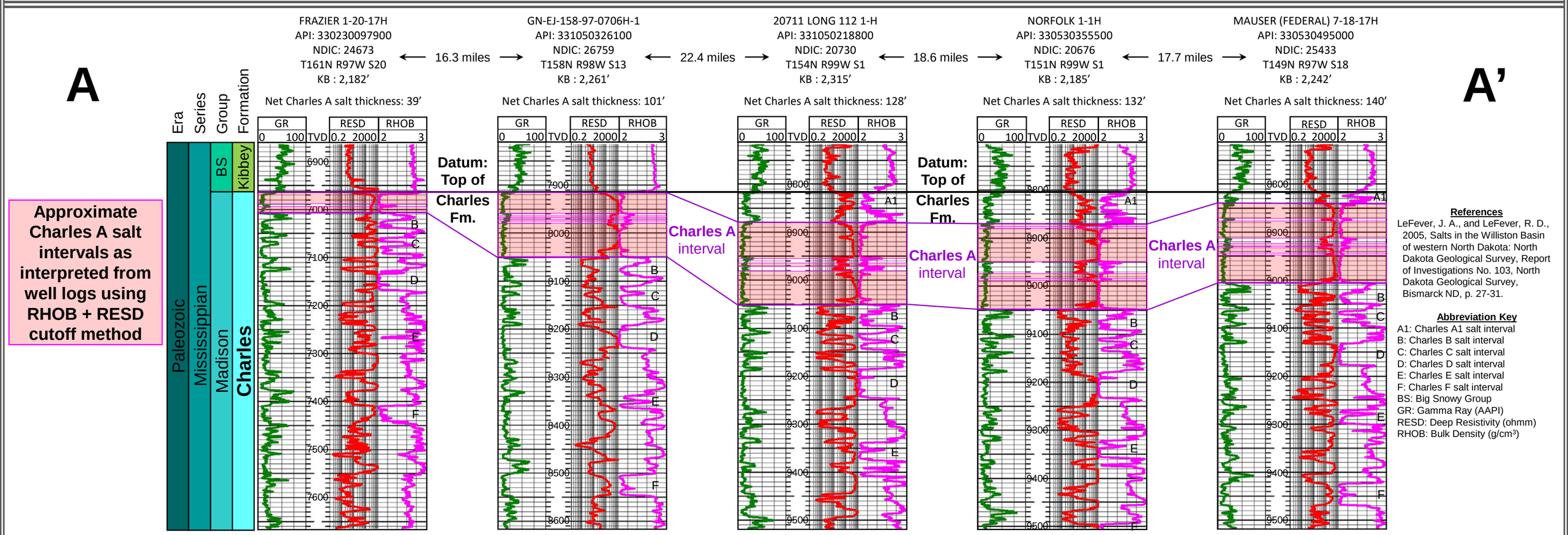


Figure 1. (***LEFT***) Location map showing the lateral extent of the Charles A salt in pink. The ***black dashed line*** represents the approximate lateral extent of the overlying Charles A1 salt (LeFever & LeFever, 2005). The black circles represent the approximate location of the corresponding wells in the stratigraphic cross-section in Figure 2 (*below*).

Figure 2. (***BELOW***) Five example well logs of the Charles A interval and surrounding strata from west-central North Dakota plotted in a stratigraphic cross-section utilizing the Charles Formation (Madison Group) top as the datum. Spanning most of the basin, these wells show similar sediment packages in the Charles Formation with variable net salt thicknesses. The Charles A salt lies at or near the top of the Charles Formation which contains alternating deposits of carbonates and evaporites. The top of the Charles A interval (*upper purple line*) is defined as the top of the uppermost salt, except where the less extensive Charles A1 salt is present and varies regionally. The Charles A1 lateral extent is represented by the black dashed line in Fig. 1 (left). The base of this interval (*lower purple line*) is defined as the base of the uppermost salt, except where the smaller Charles A1 salt is present and similarly varies regionally. Where the Charles A1 salt interval is present, the Charles A is the second uppermost salt interval in the Charles Formation. The approximate location of other Charles salt intervals are labeled in each RHOB track on the cross-section below.



References

LeFever, J. A., and LeFever, R. D., 2005, Salts in the Williston Basin of western North Dakota: North Dakota Geological Survey, Report of Investigations No. 103, North Dakota Geological Survey, Bismarck ND, p. 27-31.

Abbreviation Key

A1: Charles A1 salt interval
B: Charles B salt interval
C: Charles C salt interval
D: Charles D salt interval
E: Charles E salt interval
F: Charles F salt interval
BS: Big Snowy Group
GR: Gamma Ray (AAPI)
RESD: Deep Resistivity (ohmm)
RHOB: Bulk Density (g/cm^3)