

# Alumina Content of Paleocene Claystones

## Bowman 100K Sheet, North Dakota

Wilcox	Belfield	Dickinson
Baker		Mott
Elkalla	Camp Creek	Lemmon

Adjoining 100K Maps



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Only a handful of studies have published the alumina (Al<sub>2</sub>O<sub>3</sub>) contents of claystones in western North Dakota. Clarke (1948), Clarke (1959), Chew and Boyd (1960), Prichard (1980), and Murphy (2012, 2013) collected 417 samples primarily from the Chalky Buttes in Slope County and the Little Butlands in Stark County. All but eight of his samples were from santonites (primarily the South Heart Member of the Chadron Formation). Clarke's sample localities were not plotted on any of the map sheets because the current project is focused on the alumina content of kaolin deposits.

Hansen (1959) collected 125 claystone samples from 44 sites in the Bear Den Member of the Golden Valley Formation and in the Sentinel Butte and Bullion Creek Formations. The only Hansen sample site that plots on this map represents two analyses. The placement of Hansen's sample sites is not exact because the locations were only listed down to the section (square mile). Hansen used the legal description as his sample number.

Chew and Boyd (1960) reported alumina values for 52 sample sites in western North Dakota. They plotted the sample locations on county maps published by the ND Highway Department at one inch to the mile and a map of the Deep Creek area at 0.125 inches to the mile. They also mapped the surface bedrock units, but in the absence of topographic base maps their geologic contacts are not very accurate. In numerous instances their locations were modified for a more accurate plot on the North Dakota Geological Survey's surface geology base maps. All of the Chew and Boyd analyses reported on this map are from single samples. Chew and Boyd sample numbers were not plotted on the map because no additional published data is available.

The North Dakota Geological Survey collected 232 samples from 62 localities in western North Dakota in 2011 and 2012. The initial results were published in NDGS Geologic Investigations no. 158 and the full report will be published in NDGS Report of Investigations no. 112. Multiple samples were collected from all but the most limited outcrops. The NDGS alumina values plotted on this map represent an average of three analyses (range from 2 to 5) per site. Only sample 55 represents a single analysis. The alumina value is a weighted percent (the sum of individual analyses were multiplied by individual bed thickness and then divided by the thickness of the entire kaolin layer).

### REFERENCES

Carlson, C.G., 1978, Geology of Bowman and Adams Counties, North Dakota: North Dakota Geological Survey No. 65, Part 1, 29 p.

Chew, R.T.H. and Boyd, G.A., 1960, A preliminary investigation of clay deposits in Minnesota, North Dakota, Montana, North Idaho, and Washington: Northern Pacific Railroad Company, Properties and Industrial Development Department, 161 p.

Clarke, F.F., 1948, Southeastern North Dakota clay deposits: Stark, Slope, and Billings counties, N.Dak.: U.S. Bureau of Mines Report of Investigations, 3219, 32 p.

Hansen, M.H., 1959, Clays of North Dakota as a potential source of alumina: North Dakota Geological Survey Report of Investigations no. 33, 15 p.

Murphy, E.C., Hoganson, J.W., and Fosman, N.F., 1993, The Chadron, Beule, and Arikaree Formations in North Dakota: the status of western North Dakota: North Dakota Geological Survey Report of Investigations No. 90, 144 p., 7 plates.

Murphy, E.C., 2012, Alumina content of the Bear Den Member and the Rhame Bed in North Dakota, North Dakota Geological Survey Geologic Investigations no. 158.

Prichard, G.H., 1980, Authigenic kaolinite in the Bear Den Member (Paleocene) of the Golden Valley Formation in southwestern North Dakota, unpublished Master's Thesis, University of North Dakota, 174 p.

Wehrfritz, B.D., 1978, The Rhame bed (Slope Formation, Paleocene). A siliceous and deep-weathering profile, in southwestern North Dakota, unpublished Master's Thesis, University of North Dakota, 158 p.

### EXPLANATION

- 48 Sample or Site I.D.
- 18% Alumina Percent
- 13' Bed Thickness (underlined if it is the entire bed)
- Hansen (1959)
- Chew and Boyd (1960)
- Murphy (2012)
- Sample not analyzed

**WHITE RIVER AND ARIKAREE Strata (Eocene through Miocene)**  
The White River and Arikaree rocks were plotted on this map because they may contain various concentrations of erionite. Erionite is a fibrous zeolite that has been identified by the World Health Organization as a Group 1 carcinogen. Any proposed mining of the Bear Den in the vicinity of White River or Arikaree rocks will require the overburden to be tested for erionite and could, depending upon results, curtail mining in the area.

**GOLDEN VALLEY FORMATION (Paleocene and Eocene)**  
The Bear Den Member is generally at the surface along the outer edges (contact between the Golden Valley and Sentinel Butte Formations) of the deposit.

**RHAME BED (Paleocene)**  
The top of the Rhame Bed marks the contact between the Slope Formation and the overlying Bullion Creek Formation. The Rhame Bed contacts west of the town of Bowman were taken from Wehrfritz (1978) and Carlson (1979) except in the vicinity of Medicine Pole Hills which came from Murphy and others (1993). Contacts east of Bowman were taken from Carlson (1979). Wehrfritz and Carlson mapped at a scale of 1:125,000 and Murphy and others mapped at a scale of 1:24,000.

Geology Undifferentiated

### Other Features

- Water
- Water - Intermittent
- River/Stream - Perennial
- River/Stream - Intermittent
- Section Corners
- County Boundary
- State Highway
- Paved Road
- Unpaved Road

Scale 1:100,000

Miles 0 1 2 3 4

Mercator Projection 1927 North American Datum  
Standard parallel 46°00' Central meridian 103°30'

Note: This map was expanded beyond the normal Bowman 100K Sheet to include an additional width of two miles west to the Montana border and an additional height of four miles south to the South Dakota border.