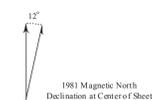




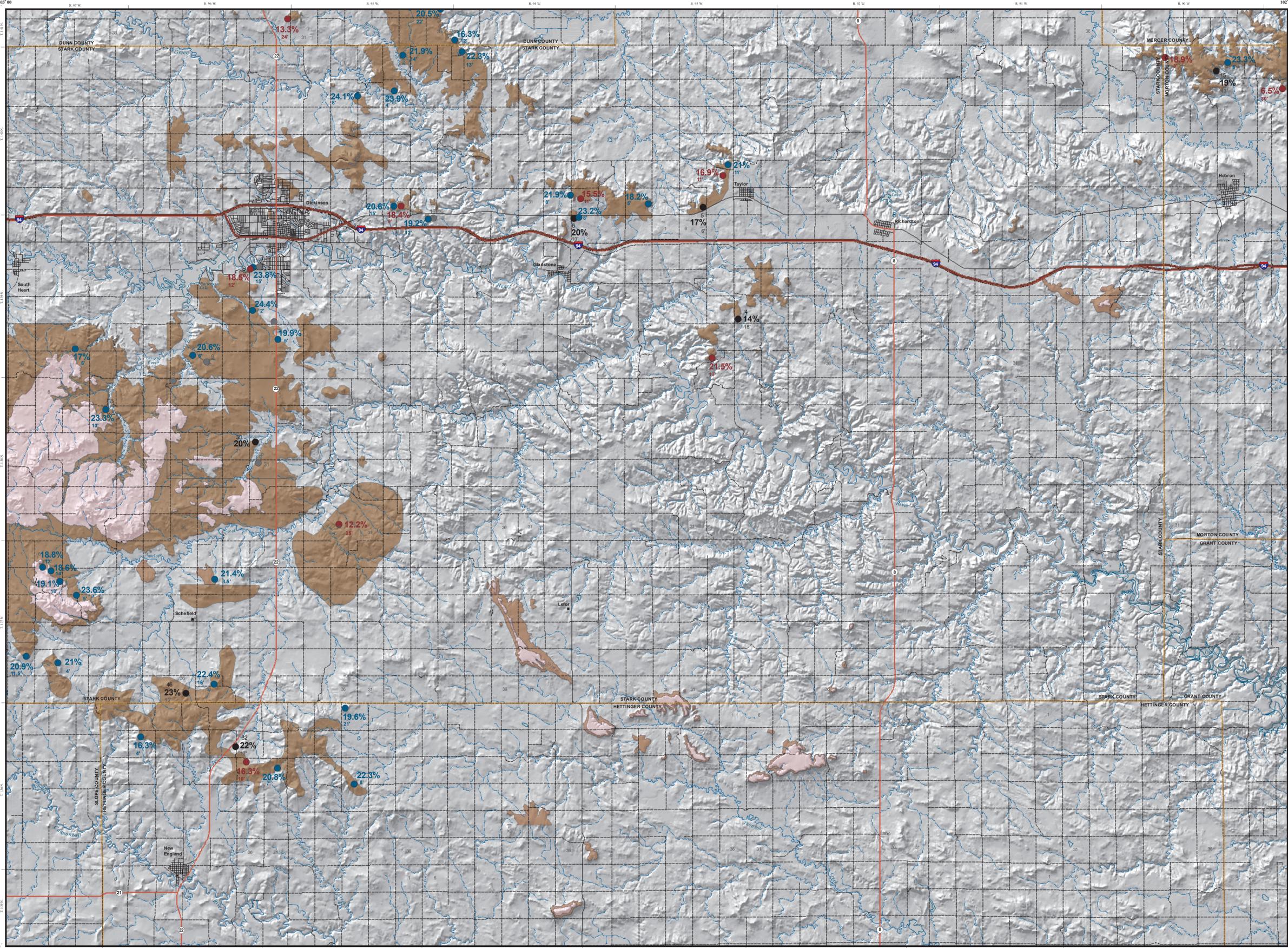
Alumina Content of Paleocene Claystones

Dickinson 100K Sheet, North Dakota

Grassy Butte	Killedeer	Hazen
Beffield		Glen Ullin
Bowman	Mott	Elgin



Edward C. Murphy
2013



Only a handful of studies have published the alumina (Al₂O₃) contents of claystones in western North Dakota: Clarke (1948), Hansen (1959), Chew and Boyd (1960), Prichard (1980), and Murphy (2012). Clarke (1948) collected 417 samples primarily from the Chalky Buttes in Slope County and the Little Badlands in Stark County. All but eight of his samples were from bentonites (primarily the Stark Heam 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. Of the ten Hansen sample sites that plot on this map, only two represent a single analysis (T136N., R97W, section 13 and T.140N., R93W, section 29) the others are the averages of 2 to 24 sample 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 southwestern North Dakota 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. Chew and Boyd collected the majority of their samples from the Bear Den Member within a 20 mile radius of Dickinson. Thirty-one of their sample sites are within this map. All of the Chew and Boyd analyses reported on this map are from single samples except for four sites (T137N., R98W, section 25, T.137N., R97W, section 30, T.137N., R97W, section 7, and T.138N., R97W, section 9.) which is the average of two 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 seven NDGS alumina values plotted on this map represent an average of four analyses (ranging from 1 to 11) per site. 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

Chew, R.T. III and Boyd, G.A., 1960. A preliminary investigation of clay deposits in Minnesota, North Dakota, Montana, Northern Idaho, and Washington; Northern Pacific Railroad Company, Properties and Industrial Development Department, 161 p.
 Clarke, F.F., 1948. Southwestern North Dakota clay deposits Stark, Slope, and Billings counties, N. Dak.; U.S. Bureau of Mines Report of Investigations 3219, 32 p.
 Hansen, Miller, 1959. Clays of North Dakota as a potential source of alumina, North Dakota Geological Survey Report of Investigation no. 33, 15 p.
 Murphy, E.C., 2012. Alumina content of the Bear Den Member and the Rhame Bed in North Dakota; North Dakota Geological Survey Geological 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.

EXPLANATION

- 19 Sample or Site I.D. ● Hansen (1959)
- 25% Alumina Percent ● Chew and Boyd (1960)
- 20' Bed Thickness (underlined if it is the entire bed) ● 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 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.
- Geology Undifferentiated - Primarily Sentinel Butte Formation

- ### Other Features
- Water
 - Water - Intermittent
 - Water - Inundated
 - River/Stream - Perennial
 - River/Stream - Intermittent
 - Section Corners
 - County Boundary
 - Interstate Highway
 - State Highway
 - Paved Road
 - Unpaved Road

Scale 1:100,000



Mercator Projection 1927 North American Datum
Standard parallel 46°30' Central meridian 102°30'
USGS NED Shaded Relief - Vertical Exaggeration 9x