North Dakota Geological Survey
100K Series: GrsB - u

Uranium

Grassy Butte 100K Sheet, North Dakota

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Grassy Butte 100K Sheet, North Dakota

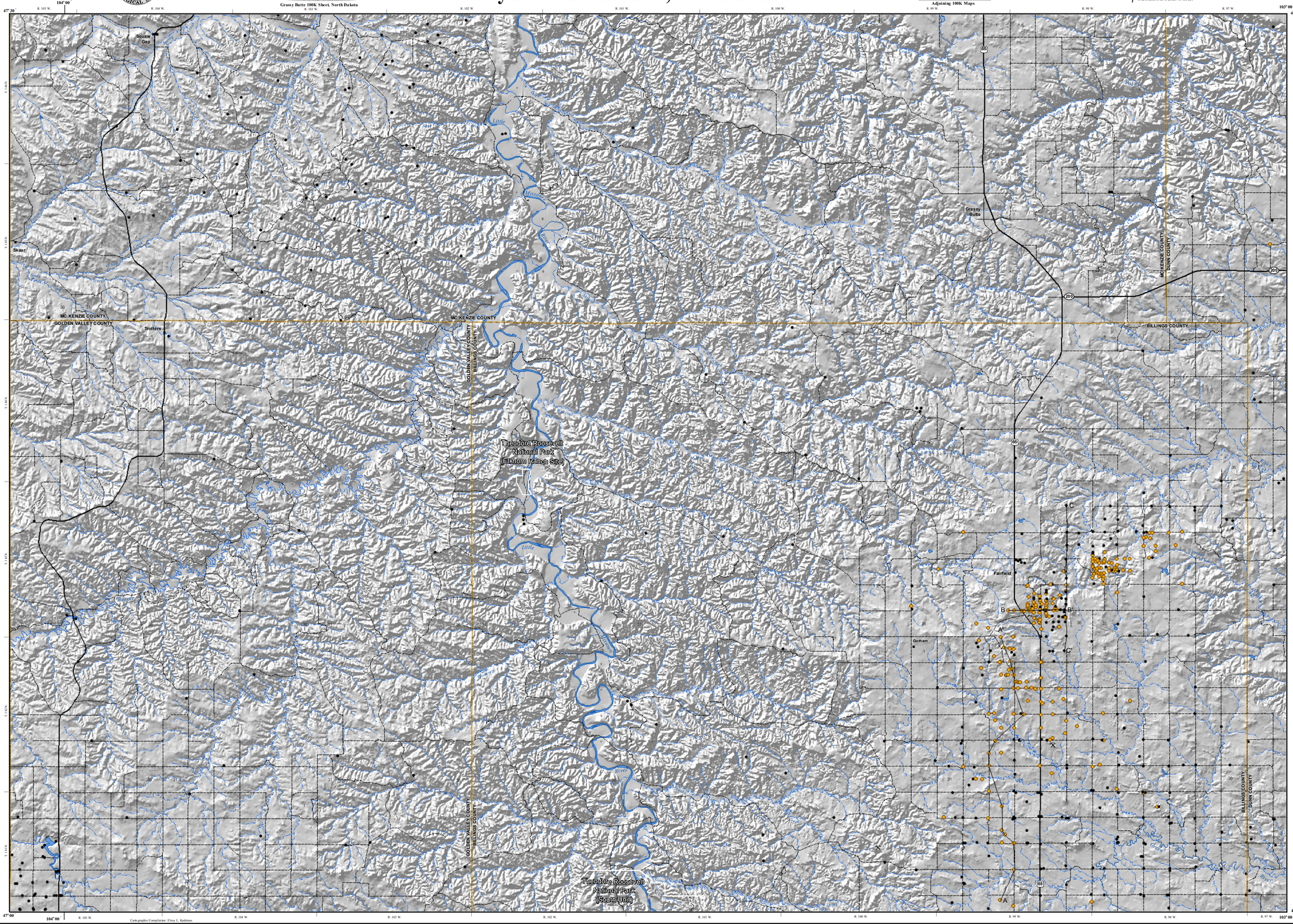
Sidney	Watford City	Parshall
Glendive		Killdeer
Wibaux	Belfield	Dickinson

Adjoining 100K Maps

12° 30'
1983 Magnetic North
Declination at Center of Sheet

Edward C. Murphy

2007



Cartographic Compilation: Elroy L. Kadrmas

Rocks exposed at the surface of the Grassy Butte 100K sheet are primarily 60 million year old sandstones, siltstones, claystones, mudstones, and lignites of the Sentinel Butte and Bullion Creek Formations (Paleocene). The Golden Valley Formation is present in upland settings in the Fairfield area. The Golden Valley Formation (Paleocene to Eocene) consists of alternating beds of sandstone, siltstone, claystone, mudstone, and lignite. The Golden Valley is split into two members; the lower member (Bear Den) is Paleocene in age and consists primarily of kaolinitic-rich claystones and mudstones. The upper member (Camels Butte) is Eocene in age and lithologically similar to the underlying Sentinel Butte Formation (Murphy et al., 1993). The Fort Union Group (Sentinel Butte, Bullion Creek, Slope, Cannonball, and Ludlow Formations) has a maximum thickness of about 1,800 feet in this area (Murphy, 2006).

Volcanic-rich White River strata are the likely source rocks for uranium in this area (Denson and Gill, 1965). Over millions of years, groundwater has leached uranium from this strata and deposited it in the underlying carbonaceous rocks and sandstones within the Golden Valley Formation and Fort Union Group. According to this model, uranium should be concentrated in the stratigraphically highest lignite or carbonaceous zone beneath the White River unconformity. As expressed in the gamma logs within this map sheet, and demonstrated in the enclosed cross sections, this is not always the case.

The North Dakota Geological Survey's database for the Grassy Butte Sheet contains exploration holes and monitoring wells that have electric logs to the surface. These electric logs are typically suites of gamma, resistivity, density, and to a lesser degree spontaneous potential or sp. The gamma probe passively measures the natural radioactivity in the borehole. Zones or horizons of increased radioactivity are recognizable as spikes on gamma logs. All gamma logs in this database were examined for radioactive spikes or indicators of increased radioactivity on the log traces. Background radioactivity of Golden Valley and Fort Union strata on the Power Resources Corporation gamma logs in this area ranges from 20 to 40 gamma counts per second (gcps). The magnitude of most gamma spikes or deflections in this area was less than 200 gamma counts with a high of 750 gcps.

Gamma spikes were detected in electric logs from exploration holes and monitoring wells covering six townships in the southeast corner of this map sheet (Ts 141-143N, Rs 98 and 99W). Making this the single largest area of uranium indicators in North Dakota. Based on the existing drillholes, there are three trends within this area; north-south, northwest-southeast, and southwest-northeast. The north-south trend continues into the adjacent Belfield 100K Sheet. The strong southwest-northeast trend, just to the south of Fairfield, somewhat coincides with outcrops of the Golden Valley Formation. This trend may parallel a structure in the Golden Valley/Sentinel Butte contact that has since been eroded.

The zones of increased radioactivity in this area generally occur at two horizons; in an upper channel sandstone within 100 feet of the surface or within a lower channel sandstone 300 to 400 feet beneath the ground surface. The highest gamma counts in the cross sections in this area were generally found within 100 feet of the surface. The lithology of cross section A is dominated by a near-surface channel sandstone that is exposed at the surface in several areas. The majority of gamma spikes in this section occur at either the top or the base of this sandstone. Gamma spikes were found to depths of about 200 feet. Conversely, several zones of increased radioactivity occur within 5 to 10 feet of the surface with gamma counts as high at 500 gcps. At one locality, gamma counts within the soil horizon were 150 gcps. Section B is also dominated by two channel sandstone systems. In several localities, the lower channel sandstone lies immediately above lignite. In Section C, the magnitude of the gamma spikes was generally low (less than or equal to 100 gcps), typically occurring at the base of the upper or lower channel sandstone.

Ken Karsmizki (1990) reported only one abandoned uranium mine within this map sheet. The Klym Mine (T142N, R99W, section 26) was a 15-foot-deep pit, covered approximately 50 acres, and operated from 1967 to 1968. A shallow, uraniferous lignite in a drillhole adjacent to this mine had a gamma count of approximately 1,400 gcps. Karsmizki believes that the uraniferous lignite was burned on site at this mine and then shipped to either South Dakota, Colorado, or Utah for further processing. The records of uranium production are very incomplete and confusing. Unfortunately, much of this was purposely done to provide confidentiality for production figures from individual mines. As an example of this, the ND Public Service Commission reclaimed a uraniferous lignite mine (14 acre site) within this map sheet (the Belfield or Oyhus Mine in T141N, R100W, section 15) that Karsmizki noted contained a uraniferous lignite, but no indication that it had been mined (Knell, 2004).

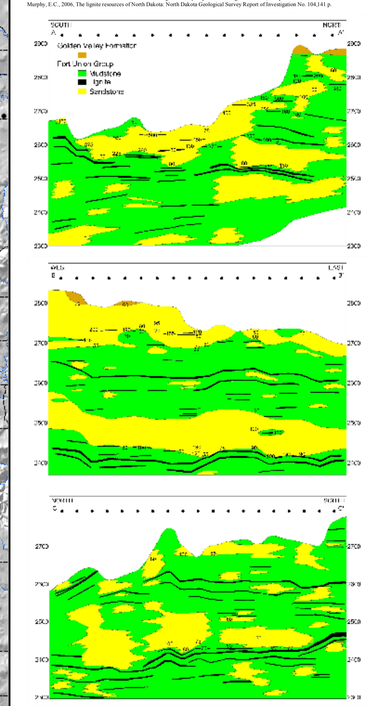
References

Denson, N.M., and Gill, J.R., 1965, Uranium-bearing lignite and carbonaceous shale in the southwestern part of the Williston Basin– a regional study: United States Geological Survey Professional Paper 463, 75 p.

Karsmizki, K.W., 1990, USDK uranium industry context statement, prepared for UNDAR/West: Western History Research, Bozeman, Montana, 79 p.

Murphy, E.C., Hoganson, J.W., and Forsman, N.F., 1993, The Chadron, Brule, and Arikaree Formations in North Dakota; the buttes of southwestern North Dakota: North Dakota Geological Survey Report of Investigation No. 96, 144 p.

Murphy, E.C., 2006, The lignite resources of North Dakota: North Dakota Geological Survey Report of Investigation No. 104,141 p.



Cross sections through Golden Valley and Fort Union strata in the Grassy Butte map sheet. The numbers in the diagram are the gamma counts per second (gcps) obtained from spikes on gamma logs. The gcps correspond to the stratigraphic position from which they were detected.

Geologic Symbols

- Geophysical logs that contain one or more gamma spikes, indicating the presence of Uranium
- Geophysical logs that do not contain gamma spikes. Data points include coal exploration and subsurface mineral drill holes, oil and gas wells, and ND State Water Commission drill holes.
- Old Uranium Mines
- A — A' Cross-Section

Other Features

- Water
- Water - Intermittent
- Riv-er/Stream - Perennial
- Riv-er/Stream - Intermittent
- National Park Boundary
- County Boundary
- Section Corners
- US Highway
- State Highway
- Paved Road
- Unpaved Road

Scale 1:100,000

0 1.75 3.5 7 3.5 7 miles

Mercator Projection
Standard parallel 47°00'
1927 North American Datum
Central meridian 103°30'
USGS NED Shaded Relief - Vertical Exaggeration 5x

Note: This map was expanded by one five normal Grassy Butte 100K Sheet to include an addition of two miles to the Montana border.