OLD DATA FINDS NEW INTEREST

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INTRODUCTION

Commodity cycles for uranium oxide, commonly known as yellow cake, have resulted in periodic waves of exploration interest in North Dakota. The first cycle which led to uranium exploration in the state occurred in the late 1950s, and uranium was produced from 1962-1967 in mines located both north and south of the town of Belfield. One of these mines was the Fritz (or Church) Mine, located first in Billings County and later also producing in Slope County (fig. 1). Nine years after uranium mining ceased in North Dakota, increased commodity prices generated a new round of uranium exploration between 1976 and 1980. At that time, most of the exploration took place between the towns of Belfield and Fairfield as well as the Chalky Buttes area south of Amidon. The uranium was found in coals and sandstones of the Sentinel Butte Formation. The price of uranium began another upcycle in 2004 as stockpiles of uranium decreased around the world (Murphy, 2008). Prices peaked at $136 per pound in June of 2007, sparking a renewed interest in North Dakota's uranium deposits.

The North Dakota Geological Survey (NDGS) issued two permits in May of 2008 to Formation Resources, Inc. to explore for uranium in southeastern Billings and northern Slope counties. The basic data generated from the exploration activities under these permits was submitted to the NDGS, where the information has been archived. This information is available to the public since there is no longer an active mining interest being pursued by Formation Resources, Inc.

BASIC DATA

Formation Resources, Inc. primarily targeted two, near-surface coals ranging in thickness from 1 to 16 feet (0.3 to 4.9m) in the vicinity of the old Fritz Mine (Murphy, 2009) (figs. 1 and 2). They analyzed these coals for uranium and its associated metals; molybdenum, germanium, and arsenic.

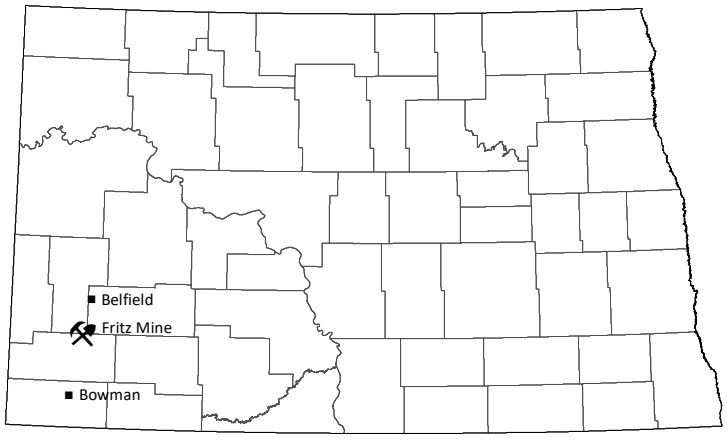

FIGURE 1.
State map showing the location of the old Fritz Mine in relation to the towns of Belfield and Bowman.

Formation Resources drilled 400 boreholes ranging from 8 to 205 feet (2.4 to 62.5 m) in depth, excavated several dozen trenches, and analyzed 1,788 core and trench samples (table 1). In addition, they took 2,113 field radiation measurements.

The vast amount of data that Formation Resources collected in a relatively small area provides important insight into the lateral and vertical variability of mineralized lignite in North Dakota. This is especially true for germanium, which is one of the critical minerals that we have been pursuing in our critical mineral project in western North Dakota. The average concentration of germanium from the Formation Resources exploration program (28.6 ppm) is twice that of a typical North Dakota lignite (14 ppm) based on the NDGS's more widely distributed sampling efforts (see figure 1 on page 2 of this publication to see sampling locations to date in the western North Dakota study; Moxness, 2022). As can be expected from an area known to be enriched in uranium, Formation Resources' average concentrations of uranium (337 ppm),

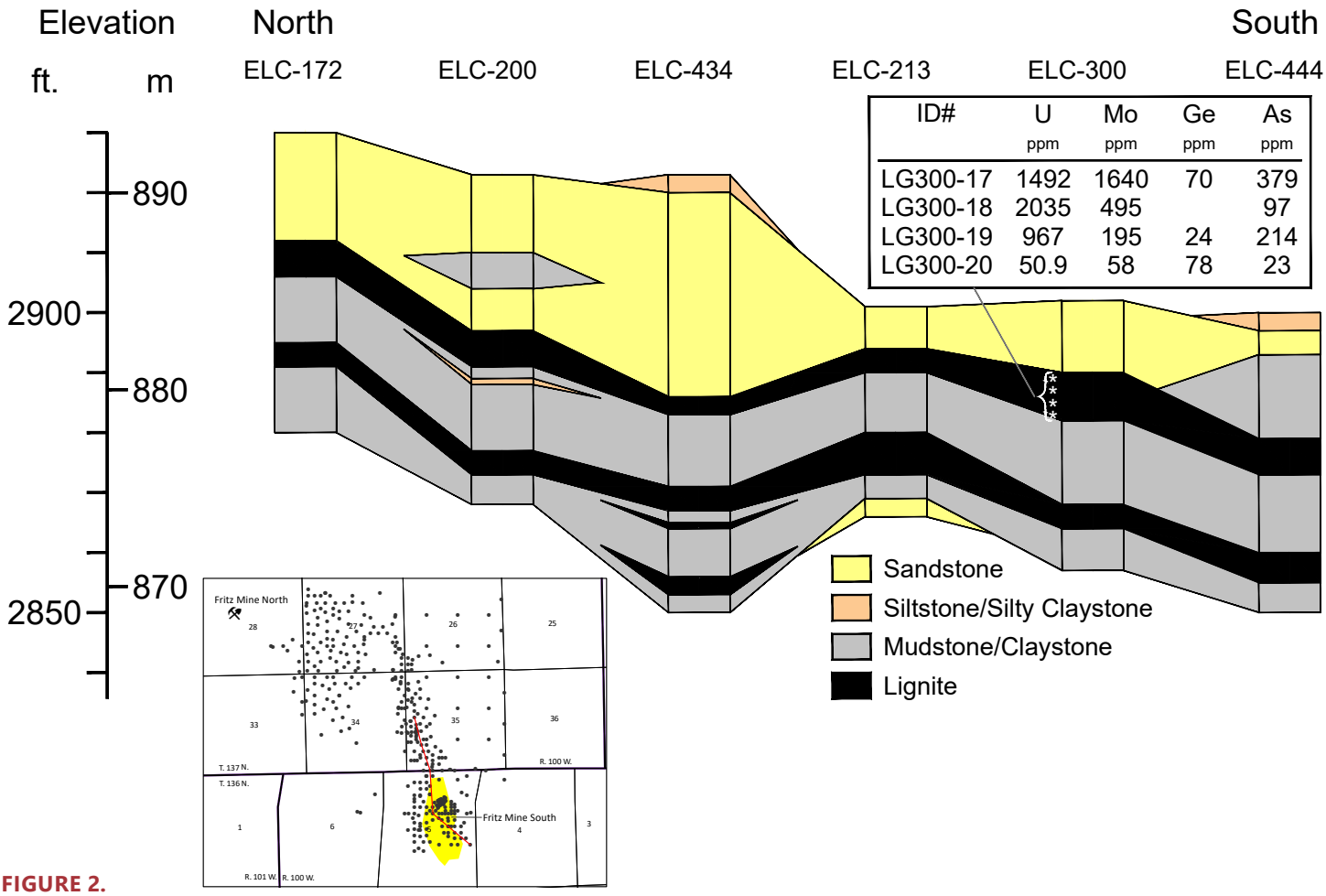

FIGURE 2.
Cross-sectional representation of the stratigraphy from six boreholes in the southern portion of Formation Resources, Inc.'s study area. Section position is displayed as the red line in the inset. An example of laboratory measurements for uranium, molybdenum, germanium, and arsenic are given for four samples collected at one foot intervals in one of the coals.

TABLE 1.
Analytical statistics comprised of maximum, minimum, mean, and median concentrations of uranium, molybdenum, germanium, and arsenic from core samples and trench samples.

Drillhole and trench assays:	U (ppm)	Mo (ppm)	Ge (ppm)	As (ppm)
# samples:	1,650	1,649	1,609	1,650
Max:	48,000	19,896	188	3,580
Minimum:	< 4	< 2.5	< 5	0.48
Mean:	337	212	28.6	128
Median:	17.0	16.0	< 5	28.5

molybdenum (212 ppm), and arsenic (128 ppm) also exceed the averages of a more typical lignite (17, 29, and 75 ppm, respectively, based on the NDGS data). We visited this area of known mineralization in 2017 to investigate if rare earth elements might also be enriched alongside uranium in these lignites (Kruger et al, 2017). The 31 NDGS samples from nine measured sections in and adjacent to the old Fritz mines contributed to a growing dataset suggesting rare earths are not closely correlated, but with such high concentrations of other elements, the Formation Resources' dataset is noteworthy regardless, and serves as the best example of a well-characterized uraniferous deposit in North Dakota.

REFERENCES

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