With the recent passage of the Bipartisan Infrastructure Bill in Congress, a rush on construction materials such as Portland cement is anticipated as cement consumption rebounds in the next several years (Miller, 2021; PCA, 2021a). Portland cement is made from a mixture of calcium, silicon, aluminum, iron, and minor oxide constituents, typically found in limestone and shale which is heated to melting and ground into fine powder with the addition of gypsum as a binder. Cement is the binding ingredient of concrete, making around 11% of the mix, which effectively “glues” the aggregate together into a cohesive, strong material. North Dakota imports all of its cement from outside sources, and those shipments increased in 2021 (Hatfield, 2021) (fig. 1).

Common source materials for Portland cement are limestones (calcium carbonate) or marls (combined with shale, clay, silica sand, and iron ore). Recently, Portland cement manufacturers have come up with a new carbon footprint reduction which allows for a higher ground limestone content ranging from 5% to 15% limestone instead of the traditional 5% (PCA, 2021b). This translates to increased demand for carbonate source materials that can potentially supply these new requirements such as the chalky and calcareous shale members of the Niobrara Formation in northeastern North Dakota (fig. 2).

The Niobrara Formation is found to outcrop at some locations in northeastern North Dakota and generally subcrops beneath a thin veil of glacial cover in Pembina, Walsh, and Grand Forks counties making it an attractive exploration target (fig. 3).

The Niobrara Formation in northeastern North Dakota is calcareous (>50% calcium carbonate) and was utilized as a natural cement with historical production for over 17 years in the late 1800’s and early 1900’s near the town of Concrete (Leonard, 1912). North Dakota Geological Survey (NDGS) geologist Clarence (Kelly) Carlson investigated the shallow subcrop of the Niobrara Formation and reported on its possibilities for use as cement rock (Carlson, 1964) at several different localities in northeastern North Dakota (fig. 2).

The NDGS took a detailed look at the Shawnee-McCanna Prospect in 2005 as industry interest in this area was increasing at the time. A series of geologic maps, cross-sections, and core summaries were completed (fig. 3) providing a more detailed look at
the cement rock possibilities of western Grand Forks County. The resulting report features descriptions of Niobrara core samples coupled with detailed calcium carbonate analytical testing data (Anderson, 2005), important data for the evaluation of this resource potential.

The NDGS maintains the cores (fig. 4) and samples from these projects at the Wilson M. Laird Core and Sample library on the campus of the University of North Dakota. The core is available for study and additional testing upon request.

Additional studies of cement rock (limestone) possibilities were also completed on several of the Buttes in Hettinger and Stark counties in southwestern North Dakota (Hansen, 1953) and on the Red River Formation, a limestone which subcrops (fig. 5) beneath glacial sediments in the Red River Valley north of Grand Forks at depths of 200 feet (Anderson and Haraldson, 1969).

With a projected surge in demand in North Dakota as well as the U.S., and renewed interest in the possibilities of using the calcareous portions of the Niobrara Formation and other units as potential cement rock resources (fig. 6), perhaps the cement rock industry will see a revival of activity in northeastern North Dakota in the coming years.
Figure 6. An outcrop of the Niobrara Formation in the Tongue River Valley near the old cement plant in Cavalier County. NDGS emeritus paleontologist John Hoganson can be seen studying the outcrop in 1994.

References


Miller, A., 2021, Concrete and cement industries brace for demand boom from $1 trillion infrastructure plan, CNBC, Friday, August 20, 2021, Concrete and cement industries brace for demand boom from $1 trillion infrastructure plan (cnbc.com), accessed November 22, 2021.
