

Powder X-ray Diffraction Analysis of Rock Samples

The Alberta Geological Survey (AGS) has commissioned four digital datasets on the composition of 700 rock samples collected from multiple locations across Alberta. The datasets include bulk mineralogy data for 500 igneous and metamorphic rock samples and bulk mineralogy, clay speciation, and total carbon and sulphur data for 200 sedimentary rock samples. Digital datasets 2024-0001 to 2024-0004 are available for download from the AGS website.

Mineralogy is the study of the chemical and physical properties of minerals. Rocks are composed of minerals, each mineral having a unique crystalline structure. X-ray diffraction (XRD) analysis was used to obtain bulk mineralogy and clay speciation data. Mineral types can be identified based on how X-rays interact with the crystalline structure of the minerals in a sample. Because clay minerals have a highly complex and variable structure, additional steps were required to prepare the samples for XRD analysis. Samples were treated with chemicals and heated, which helps to distinguish different types of clay minerals when using XRD. The total carbon and sulphur content of each sample was determined by

combusting it in a high-temperature furnace, capturing the carbon dioxide and sulphur dioxide gases and measuring them.

Igneous and metamorphic rock samples analyzed for bulk mineralogy were collected from the Canadian Shield in northeastern Alberta. These rocks were formed billions of years ago during the Mesoarchean and Mesoproterozoic eras, making them some of the oldest rock samples in Alberta. The sedimentary rock samples analyzed for bulk mineralogy, clay speciation, and total carbon and sulphur content were collected during previous AGS work on shale gas potential in Alberta. Specific samples were selected for analysis based on their chemical properties, depth below surface, and source location.

Analyses of the digital datasets will help identify patterns in the distribution of critical minerals in Alberta and improve our understanding of the mineral systems in the province. The datasets may also be incorporated into new or existing models and databases to help identify areas of mineral potential or new exploration opportunities.

Highlights

X-ray diffraction (XRD) analysis was used to obtain bulk mineralogy and clay speciation data which will help identify patterns in the distribution of critical minerals in Alberta and improve our understanding of the mineral systems in the province.

Swelling clays are so named because they expand when exposed to water. This behaviour affects the volume and permeability of geological units, and can have a significant impact on structure, slope stability, contaminant mobility in the environment, and the proportion of the resource that can be recovered.



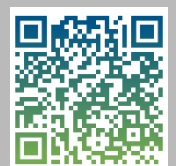
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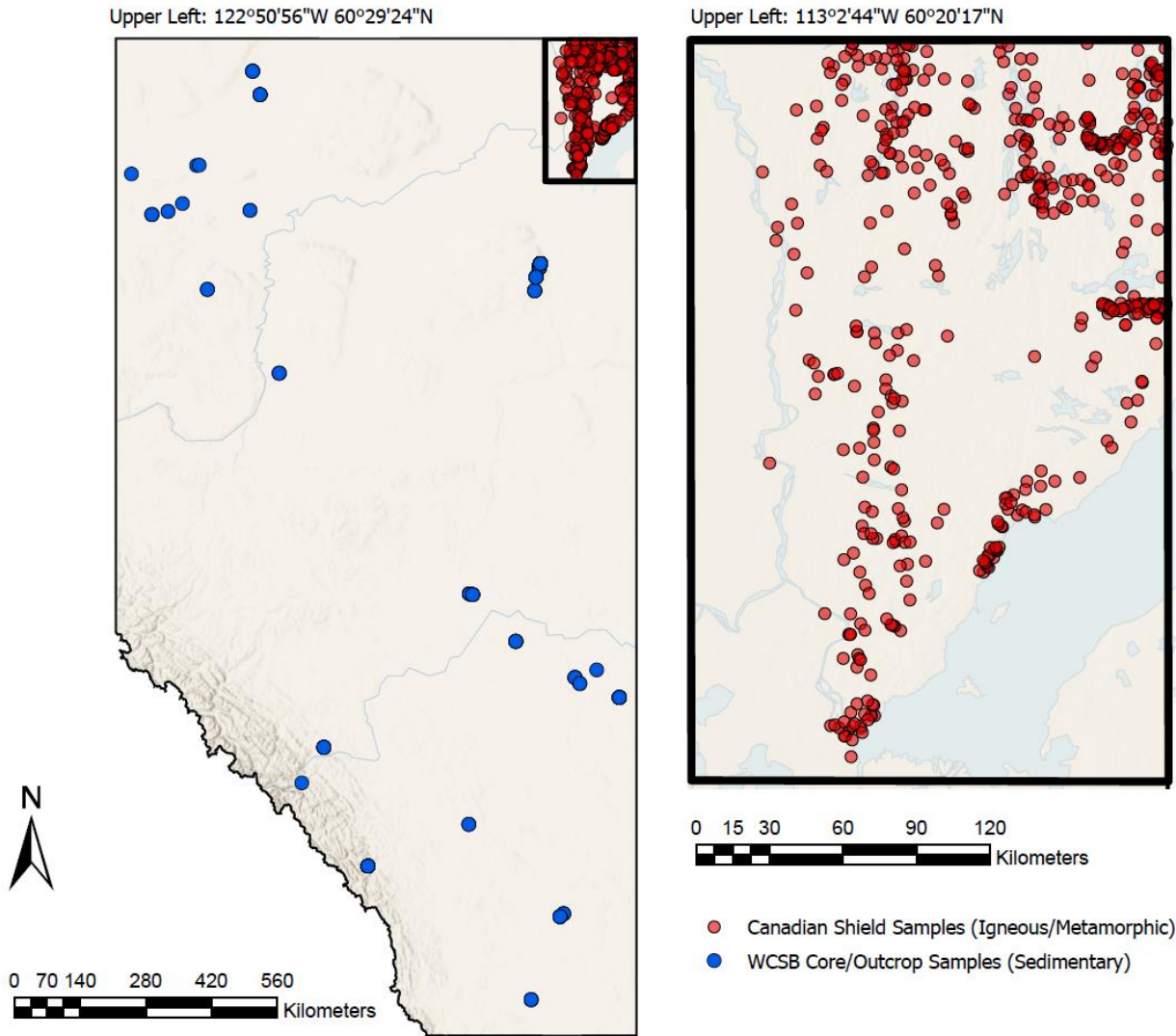


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Rock samples were collected and analyzed from various locations across Alberta.



Igneous and metamorphic rock samples were collected from the Canadian Shield in northeast Alberta and were deposited during the Mesoarchean era. The sedimentary rock samples were collected from various locations within the Western Canadian Sedimentary Basin (WCSB) and range in age from the Devonian period to the Cretaceous period.