DIAGENETIC PATTERNS IN CAMBRIAN SANDSTONE IN WESTERN WISCONSIN: CONSTRAINING POTENTIAL SOURCES OF AIRBORNE PARTICULATE MATTER

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ABSTRACT

The Wonewoc and Jordan formations are Cambrian sandstone units in west-central Wisconsin. Both formations are dominated by detrital quartz grains (67 to 68%, respectively) and pore spaces (20 to 21%, respectively). The Wonewoc Formation is characterized by a higher proportion of void space (83%) than the Jordan Formation (54%). The Wonewoc Formation exhibit a higher percentage of authigenic quartz (17.6%) compared to the Jordan Formation (11.4%). Hematite cement (10%) is the most common cement component in both formations, while detrital quartz is the least common (9.2%). These results suggest that the Wonewoc Formation is more susceptible to dust generation during the mining and disaggregation process.

INTRODUCTION

Cambrian sandstone units in west-central Wisconsin are being mined for sand and gravel and are used in a variety of applications (e.g., construction, oil and gas recovery, and hydraulic fracturing). The mining and processing of these sandstone units can generate respirable dust, which can pose health risks to workers and the surrounding community. This study aims to constrain potential sources of airborne particulate matter (APM) by analyzing the diagenetic patterns of Cambrian sandstone units in the region.

METHODS

Samples have been collected from the Wonewoc (n=17) and Jordan (n=27) formations in west-central Wisconsin. Samples have been cut perpendicular to bedding, impregnated with epoxy, and made into polished thin sections. Point counts have been analyzed in EXCEL to determine the mineralogy and relative percentages of the grains, cement, and interstitial material. Petrographic examination indicates that interstitial silica cement is thought to be a major contributor to dust in the Wonewoc and Jordan formations, as it is rare to absent in prospective Cambrian sandstone units in this region.

RESULTS

The Wonewoc Formation is characterized by a higher proportion of void space (83%) than the Jordan Formation (54%). The Wonewoc Formation exhibit a higher percentage of authigenic quartz (17.6%) compared to the Jordan Formation (11.4%). Hematite cement (10%) is the most common cement component in both formations, while detrital quartz is the least common (9.2%). These results suggest that the Wonewoc Formation is more susceptible to dust generation during the mining and disaggregation process.

CONCLUSIONS

Silica sand is used in the hydraulic fracturing (fracking) process to enhance oil and gas recovery. Directional drilling techniques and fractured during the mining and disaggregation process, so interstitial cement is thought to be a major contributor to dust in the Wonewoc and Jordan formations. The Wonewoc Formation is more susceptible to dust generation during the mining and disaggregation process. Petrographic examination of both raw and processed sand grain mounts yielded no evidence of fragmentation for raw sand grains from a site in Wonewoc Fm.