

Origin of Mottled fabrics and Nodules in Silurian Dolostones of the Niagara Escarpment, Ontario

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Abstract

Pervasively dolomitized Silurian carbonates of the Amabel and Guelph formations, which cap the Niagara Escarpment, display a variety of mottled fabrics and nodules which can affect the utility of these rocks for building stone or aggregate. Mottles preferentially occur parallel to bedding and within specific stratigraphic horizons related to changing seascapes along the eastern margin of the Michigan Basin. Mottle sizes range from diffuse mm-scale pyrite-dominated dark blue-grey specks to cm-scale blue-grey streaks. Compositional differences between the streaks and the surrounding rock are subtle and reflect small differences in crystal size, abundance of inclusions in dolomite crystals and the amount of undifferentiated intercrystalline organic matter. Nodules within these carbonates typically range from 1-6 cm in length and are variably oriented. Boundaries with surrounding rock are commonly sharp and stylolitic, and may be associated with pyrite. Nodule composition is variable – ranging from relatively pure microquartz to dolomite or variable mixtures of these minerals. Fossils within nodules have been altered to micro-quartz, mega-quartz and/or dolomite. Mottled fabrics and nodules may both be explained as the result of horizontally-dominated bioturbation of these shelf carbonates. Bioturbation created small, localized heterogeneities in porosity which influenced permeability and controlled the degree to which microbial oxidation could affect pore water chemistry and the precipitation of both pyrite and silica. Such early diagenetic features, which occurred during initial lithification followed by pervasive early dolomitization of these carbonates, has ramifications regarding the ultimate economic potential of these strata in the industrial minerals and petroleum exploration sectors.