# Significance of nickel-rich sulfides in drilled core samples of the 2.77 Ga Mt. Roe sedimentary rocks: TEM and magnetic studies

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The Mt. Roe Basalt is considered to be a 2.77 Ga flood basalt, widely occurring in the northern Pilbara area of Western Australia. Sedimentary rocks interbedded in the basaltic flows have been recognized by previous investigators. However, their sedimentation environments are poorly understood. Sedimentary sections of the Mt. Roe Basalt were directly drilled during the course of this study, and here we report on unknown and unique characteristics of organic carbon rich sediments in these core samples.

Six basaltic lava flows of 3 to 10 m in thickness are recognized around the drilled site, about 10 km southeast from Whim Creek. Two sedimentary sections of ca. 10 m thickness are found on specific lava flows. These sedimentary rocks are rich in clastic components, and contain cross laminations and ripple marks, suggesting rapid change in the paleo-current of shallow ocean water. These sedimentary rocks and basalts were drilled and ca. 300 m successive core sections were recovered. Surprisingly organic carbon- and sulfide-rich shale was found in the two sedimentary sections.

To identify the sulfide mineral assemblages, chemical composition and crystal structure analyses were carried out by using a high-resolution transmission electron microscope (TEM) with analytical electron microscopy. Sulfides occur as complex mineral assemblages: pyrrhotite, pyrite, pentlandite, chalcopyrite, and sphalerite. These were not recognized in the heavily weathered outcrop samples. Pyrrhotite was a dominant mineral in the assemblage. Notable features of these sulfides was the development of crystal defects in Fe-sulfides (po and py), and their abnormally high nickel concentrations (po: ~3 wt.%; py: ~1 wt.%). These crystal habits are most likely diagenetic features rather than a later low-grade metamorphic signature.

Magnetic intensities of the basalts and sedimentary rocks were also measured in the drilled core samples, varying from 1 x 10E-3 to 1 x 10E2 A/m. It is remarkable that the magnetic intensities of the sulfide-rich sedimentary rocks in the lower sedimentary section are higher than those of fresh basalt samples. Such magnetism is preserved in the Fe-sulfide minerals and crystal habits and magnetic intensities are highly correlated.