The Reef Au-Cu deposit, located in Marathon County, Wisconsin is located within the Wausau volcanic complex of the 1.8 Ga Penokean volcanic belt. The northern part of this belt is host to several volcanic-hosted massive sulfide deposits, including the world-class Crandon deposit that contains 63.5 Mt of ore grading 1% Cu and 6.5% Zn. As most of the exploration in the belt has taken place over a brief period of time in the 1970’s and 1980’s, the potential for undiscovered mineral resources is significant. This is illustrated by the discovery of the Back Forty deposit in 2002, which comprises a measured and indicated resource of 15.1 Mt grading 0.3% Cu, 3.1% Zn, 0.2% Pb, 2.0 g/t Au, and 24.5 g/t Ag.

The mineral potential of the Reef deposit was first recognized by the discovery of a number of Au-rich quartz boulders in the area in the 1970’s. Subsequent drilling by Noranda identified the presence of precious metal mineralization and follow-up drilling defined a gold-rich resource of approximately 500,000 tons grading 10.6 g/t Au and 0.3% Cu. Mineralization occurs within several distinct quartz-sulfide rich zones with some intercepts exceeding ounce per ton gold concentrations. The high precious metal grades of the Reef deposit coupled with the abundance and style of sulfide mineralization are unusual. The characteristics of the deposit differ significantly from the volcanic-hosted massive sulfide deposits discovered in the northern part of the Penokean volcanic belt. No other deposits have so far been identified in the southern portion of the belt allowing comparison with the Reef deposit.

In the past, the Reef deposit has been variably classified as an orogenic gold deposit or a gold-rich volcanic-hosted massive sulfide deposit. The mechanisms of formation of the deposit are not well understood as late deformation and possible contact metamorphism have obscured primary textures in the host rocks and possibly within the ore zones themselves. Through detailed field work, petrography, geochemistry, and fluid inclusion analysis, the present study aims to identify the conditions under which the Reef deposit formed and establish whether gold enrichment is syngenetic or epigenetic in nature. The research will provide a model which can be used for further exploration in the deposit area and the southern Penokean volcanic belt in general.