Introduction

Figure 1: Presentation picture of northern Wisconsin and Michigan showing the location of Cu-Zn-Au-cenozoic and other deposits.

The primary objective of this project is to carry out geochronological and geochemical studies of Proterozoic Cu-Au deposits in Wisconsin with the goal of providing a better understanding of the tectonic framework and evolution of the Penokean Orogeny. This terrane is one of the most important in the North American craton due to the high-grade metamorphism and the occurrence of several Cu-Au deposits. This project will focus on the development of regional geological constraints and the sampling of the footwall to the ore deposit.

Study Area and Methods

Figure 2: The Flambeau Cu-Au deposit near Clam Lake in Rusk County, Wisconsin. The deposit is hosted by metavolcanic rocks of the late Proterozoic age. The ore deposit is a large-scale deposit with an estimated ore reserve of 70 million tonnes at 1.2% Cu and 11 g/t Au.

Figure 3: Geologic map of the Flambeau Cu-Au deposit showing the distribution of the stratigraphic units and the alteration zones. The deposit is hosted by metavolcanic rocks of the late Proterozoic age.

Figure 4: The Flambeau deposit was mined between 1993 and 1997. Research focused on drill cores obtained during exploration and regional-scale mapping. Because exposed outcrop in the region is rare, our research primarily relied on drill core samples.

Volcanogenic Massive Sulphides (VMS)

Figure 5: Volcanogenic Massive Sulphides are formed in the subsurface and are associated with submarine hydrothermal vents. They represent one of the most economically important ore deposits and are found worldwide. The Flambeau deposit is one of the best-studied VMS deposits and is located in Rusk County, Wisconsin.

Figure 6: Volcanic rocks in the Marshfield subterrane are characterized by a sequence of main volcanic arc rocks, tonalite-granodiorite-granite (1760-1870 Ma), gneiss and schist (2800-3000 Ma) and metavolcanics (1730-1850 Ma). These rocks are light gray to green in color and contain a variety of minerals, including quartz, feldspar, and pyrite.

Bedrock Geology of Rusk County

Figure 7: Regional bedrock geology of Rusk County, WI, showing the distribution of different rock units. The region is dominated by metavolcanic rocks and felsic volcanic rocks.

Figure 8: Stratigraphic representation of the Flambeau VMS deposit, showing how alteration varies with depth and between different cores. The alteration chemostratigraphy indicates that ore-forming sericite-chlorite-pyrite alteration was the dominant alteration process during the formation of the Flambeau deposit.

Geology of the Flambeau VMS deposit

Figure 9: Early Proterozoic volcanogenic massive sulfide deposits in Wisconsin, showing the distribution of different rock types and ore deposits. The Flambeau deposit is one of the best-studied VMS deposits and is located in Rusk County, Wisconsin.

Figure 10: Stratigraphic representation of the Flambeau VMS deposit, showing the distribution of different rock units and alteration zones. The deposit is hosted by metavolcanic rocks of the late Proterozoic age.

Figure 11: Stratigraphic sections for the Flambeau deposit showing the distribution of different rock types and alteration zones. The deposit is hosted by metavolcanic rocks of the late Proterozoic age.

Figure 12: Stratigraphic sections for the Flambeau deposit showing the distribution of different rock types and alteration zones. The deposit is hosted by metavolcanic rocks of the late Proterozoic age.

Figure 13: Stratigraphic sections for the Flambeau deposit showing the distribution of different rock types and alteration zones. The deposit is hosted by metavolcanic rocks of the late Proterozoic age.

Conclusions

The authors would like to thank the Office of Research and Economic Support (ORES) at the University of Wisconsin-Madison for financial support. The authors also wish to thank the following people for their contributions to this project:....

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