Paper Number: 3059

The Auriferous Mississagi and Matinenda Paleoplacer Formations of the Huronian Basin

Whymark, W.E.[1,2], Frimmel, H.E.[2,3], and Minter, W.E.L.[3]

[1]Inventus Mining, Canada (wes.whymark@gmail.com)
[2]University of Würzburg, Germany
[3]University of Cape Town, South Africa

The Paleoproterozoic Huronian Supergroup, although of a younger age, portrays similar geological attributes, such as size, mineralogy and depositional setting, to the Mesoarchean Witwatersrand goldfields of South Africa, which have produced >52,000 tonnes of gold. The discovery of auriferous conglomerates within the Mississagi and Matinenda formations of the Huronian Supergroup some 65 km northeast of the Sudbury Province, has significantly increased the exploration potential for Witwatersrand-type deposits in the Canadian Shield. Subsequent drilling and surface trenching of the two formations has revealed multiple gold-bearing conglomerates over some 45 km^2. Here we report the results obtained in an ongoing study on the auriferous conglomerate units within the Pardo exploration project, operated by Inventus Mining. The aim of this research is to determine if the gold mineralization in these units represents fluvial paleoplacers.

Detailed facies analysis of drill cores and outcrop across targeted strata has illustrated a favourable relationship between gold concentration and conglomeratic units. Mineralogical, geochemical and textural analyses, including the documentation of *in-situ* gold grain morphology (by digestion in HF) and *in-situ* gold grain distribution (by µ-XRD-CT) revealed significant hydrothermal mobilization of presumably detrital gold grains. Much of the latter being sourced from eroded volcanogenic massive sulphide (VMS) and/or orogenic-type lode gold deposits. Analogues of the potential source types are well known from the Superior Province, including the Abitibi Greenstone Belt, which is located just past the northern extent of the Huronian Basin and is host to many lode-gold and VMS deposits with a total historic production of >5,500 t of gold and >450 Mt of Cu-Zn.

The low-grade metamorphosed sedimentary host rocks represent a braided river system in a large alluvial fan setting. Our results indicate that the truncation of the Matinenda Formation by the younger Mississagi Formation led to the up-grading of gold content in the latter due to sedimentary reworking of the older, stratigraphically lower Matinenda Formation. Gold in the Matinenda Formation has been observed so far only as bound to detrital pyrite. In contrast, the Mississagi Formation, which reworked the Matineda Formation, also contains gold from an orogenic lode gold source as inclusions in detrital quartz grains and lithic clasts. Subsequent post-depositional mobilization of gold from the detrital pyrite of the Matinenda Formation and possibly also within the Mississagi Formation resulted in the precipitation of authigentic/metamorphic gold in the Mississagi Formation conglomerate, likely around detrital gold particles in the form of hydrothermal grains and clusters.

Although the Pardo deposit is considered a paleoplacer, similar to many of the richest Witwatersrand reefs, distinct differences to the Witwatersrand deposit are noted. The identification of specific point sources for the gold and the somewhat lower depositional age of c. 2.4 Ga, point to an overall gold-concentration mechanism that was different compared with the Witwatersrand Basin. The principal microbial pre-

concentration of gold, suggested for the 2.9 Ga Witwatersrand strata and providing a laterally very extensive source for later placer deposition, was seemingly not effective anymore at the time of Huronian sedimentation. This may explain an overall lower gold endowment of the Huronian Basin fill. Nevertheless, our results on the Pardo project show that even in Paleoproterozoic continental successions, significant potential exists for additional economic conglomerate-hosted gold deposits to be discovered in other areas, in which similar source rocks are indicated. This might well apply to all other roughly coeval continental deposits related to the rifting of Kenorland.