New base metal discovery in the Siluro-Devonian Tobique Belt, New Brunswick

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Nova Gold Resources' Sewell Brook base metal discovery, 130 km southwest of Bathurst near Plaster Rock, represents the first volcanogenic massive sulphide deposit to be found in the Siluro-Devonian Tobique Group of northwestern New Brunswick. Like the Ordovician Tetagouche Group, which hosts numerous base metal sulphide deposits in the Bathurst district to the northeast, the Tobique Group consists of a thick succession of sedimentary rocks and bimodal volcanic rocks. However, the Sewell Brook deposit is hosted by felsic volcanic rocks and in several respects appears to conform to a Kuroko-type model, whereas most Bathurst camp deposits are hosted by fine-grained sedimentary rocks.

Volcanic rocks of the Tobique Group include massive to pillowed basalts and a series of subaqueous rhyolitic flows and domes. Rhyolites are predominantly glassy lavas, characterized by spherulitic and perlitic textures, and widespread development of pseudo-fragmental textures produced by patchy or nodular devitrification and chloritic alteration. Locally, a combination of rapid aqueous chilling and mechanical disintegration at the margins of actively moving flows has produced a thick mantle of hyaloclastic breccia and microbreccia enveloping units of massive glassy rhyolite.

At Sewell Brook, successive rhyolite/hyaloclastite sequences are separated by beds of marine siltstone and sandstone. Hyaloclastic breccias host the sulphide lenses, which can reach grades as high as 41% Pb-Zn over 19 ft. The sulphide bodies are replacement deposits, situated within the upper portion of porous hyaloclastic units, immediately beneath the (paleo) sea floor. The degree of replacement is variable: in places only the breccia matrix is replaced, whereas in the highest grade zones the entire rock is replaced by sphalerite and galena, leaving relict "ghost" shapes of fragments. A locally high-grade copper zone (e.g., 17% over 5 ft.) lies stratigraphically below the Pb-Zn zone in some drill holes; the source of this copper is unclear as mafic rocks are not present in the vicinity of the deposit.

The Sewell Brook deposits more closely resemble Kuroko-type than Bathurst-type deposits as pyrrhotite, magnetite, and Algoma-type iron formation are absent at Sewell Brook, cherty silicification is common, and the ore is hosted by brecciated felsic lavas rather than by sedimentary rocks. However, Sewell Brook differs from Kuroko deposits in that it is a replacement deposit and not a result of sea-floor exhalative activity. Furthermore, significant quantities of sulphates, especially barite, do not seem to be present. It is suggested that hydrothermal convection cells became active during periods of quiescence following extrusive activity. Hydrothermal fluids circulated freely through the rhyolites (rendered permeable by devitrification) and through porous hyaloclastic rocks, leaching Pb and Zn and producing chloritization and local silicification. Deposition of sulphides was controlled by the porosity of the hyaloclastic breccias, and by temperature (i.e., proximity to the seafloor).