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**Form and distribution of gold in the Brunswick  
No.12 volcanogenic massive sulphide deposit,  
Bathurst mining camp, New Brunswick**

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JILLIAN MARTIN, SEAN McCLENAGHAN,  
AND DAVID LENTZ

*Department of Geology, University of New Brunswick,  
P.O. Box 4400, Fredericton, NB, Canada, E3B 5A3*

The giant Brunswick No. 12 deposit is one of the world's largest Zn-Pb-Cu-Ag-type volcanogenic massive sulphide deposits. Since 1964, this 230 Mt deposit has produced over 106 Mt of massive sulphides grading 3.49 % Pb, 8.85 % Zn, 0.36 % Cu, 102 ppm Ag and has an average Au grade of 0.67 ppm, with Au values locally exceeding 30 ppm in pyretic sulphides at the north end of the Main Zone ore body. Brunswick No. 12 massive sulphides are hosted by middle Ordovician volcanoclastic rocks atop the Nepisiguit Falls Formation of the Tetagouche Group. Polyphase deformation and greenschist facies metamorphism have resulted in structural thickening of the massive sulphides, and have created four major sulphide lenses which merge with depth.

Massive sulphides at the north end of the Main zone consist of numerous pyritic lenses with variable base metal and elevated gold contents. These lenses consist predominately of thinly layered fine- to medium-grained pyrite, sphalerite, galena, and arsenopyrite with lesser barite, chalcopyrite, tetrahedrite, bismuthinite, molybdenite, and cassiterite/stannite. The shape and distribution of these pyritic lenses relative to the Main ore zone suggests that the north end lenses likely represent a fold repetition of a distal sulphide facies formed on the flanks of a giant hydrothermal system.

Drill core (1 m intervals) and bulk underground samples (~ 3 kg) of massive sulphides and host rocks (n = 58) from the 850 m and 1000 m levels of the north end main zone were assayed by Atomic Absorption Spectrometry, as well as analysed by Instrumental Neutron Activation Analysis, Inductively Coupled Plasma Mass Spectrometry, and Inductively Coupled Plasma Emission Spectrometry. Gold contents of 43 samples collected from gold-rich massive sulphides in the north end zone average 1.85 ppm and range from 0.31 ppm to 8.20 ppm. Spearman Rank correlation coefficients between elements were calculated for the 43 samples of massive sulphides from the north end lenses. Gold exhibits a moderate positive correlation with Sn ( $r' = 0.58$ ), Mo ( $r' = 0.55$ ), As ( $r' = 0.48$ ), and Sb ( $r' = 0.42$ ). The Au content of host rocks (0.36 ppm, n = 11) and cross-cutting quartz veins (0.060 ppm, n = 4), are very low. Overall, elevated gold contents are accompanied by a high modal abundance of arsenopyrite, cassiterite, molybdenite and tetrahedrite and in places barite. The Au-Sb-As association, absence of native gold and electrum, and the overall abundance of arsenopyrite suggest that Au is mineralogically bound as an invisible fraction in arsenical pyrite and arsenopyrite.