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Title: EXPLORATION IMPLICATIONS OF HYDROTHERMAL ALTERATION ASSOCIATED WITH EPITHERMAL AU-AG DEPOSITS

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Abstract: Alteration zones surrounding low sulfidation epithermal deposits are larger than the deposits and the recognition of alteration mineralogical and geochemical zonation can be used for developing vectors to the deposit. Some alteration zones have no known related ore deposit, and therefore the recognition of discriminators between fertile and barren alteration zones is also important. This abstract presents the results from a three year AMIRA International project (P588) where research was undertaken at the Ladolam, (Papua New Guinea), Gosowong, and Mt Muro (Indonesia), Cerro Vanguardia (Argentina) and Twin Hills and Bimurra (Australia) deposits.

At all the deposits investigated there is a consistent zonation of alteration with quartz-adularia and illite proximal to mineralization. Moving away the alteration becomes illite-smectite-rich before passing into distal assemblages containing varying proportions of albite, chlorite, epidote and chlorite. Distinct alteration zonation is much more pronounced in the mafic-hosted case studies (Gosowong, Mt Muro and Lihir) compared to the felsic-hosted systems (Cerro Vanguardia and Bimurra).

For the mafic-hosted deposits the consistent geochemical indicators are 1) increased Au, Ag, Te, Tl, (Cu+Pb+Zn), As, and Sb contents in and within 1- 10's meters of a deposit, and 2) increased K_2O, S, Alteration Index, S/Na_2O, Tl, As, Sb and decreased Na_2O, CaO contents in the alteration halo over distances of 10-100's of meters from a deposit. For the felsic-hosted deposits the consistent geochemical indicators are 1) increased Au, Ag, Sb, As, Tl, Te, Li, K_2O contents in and within 1 to 10's meters of a deposit, and 2) increased K_2O, Tl, As, Rb, Ba, Cs contents in the alteration halo over distances of 10 to 100's of meters from a deposit.

The most promising discriminators for distinguishing high-grade from low-grade or barren systems are alteration intensity, illite crystallinity and alteration whole-rock geochemistry. The alteration mineralogy and zonation is essentially the same between high and low-grade or barren systems, but the scale and intensity of alteration are much greater in the high grade systems. There is also a marked high or increasing illite crystallinity (>1) towards a deposit in high grade systems. Fertile structures will have a greater proportion of adularia and a positive K_2O-Tl relationship compared to non-fertile structures. Research at Cerro Vanguardia has highlighted the differences between the alteration geochemistry surrounding high and low grade veins. Overall, higher grade Au-Ag veins tend to have wall rocks and veins that contain higher K_2O (>4%), Tl (>3 ppm), Rb (>150 ppm) and Ba (>300 ppm) contents than lower grade to barren veins. These results are the first definitive geochemical criteria that can be used to distinguish high grade from low grade or barren low sulfidation epithermal veins within a district.