Paper Number: 4402

Preferential mineralization of shallowly dipping veins at the Navachab gold deposit, Namibia

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The Navachab gold deposit is situated in the Southern Central Zone of the Pan-African Damara Belt, Namibia. To a large part, the deposit is hosted by various vein sets located on the northwestern limb of a kilometer-scale, NNE-SSW-trending domal structure, the 'Karibib Dome'. Host rocks to the deposit are Damaran metasediments, namely biotite schists, marbles, and calc-silicate rocks of the Arandis Formation. Additional mineralization occurs in skarn-style replacement bodies in the marble- and calc-silicate rocks. Two shallowly NNE-plunging economic orebodies occur in the main pit area, termed the main shoot and the second shoot. The shoots are defined by vein spacing and by the occurrence of high-grade replacement bodies in the carbonate rocks. To gain information on the gold distribution in the various vein sets and on small-scale controls on the gold grade, more than 500 veins from the schist units in different parts of the mine were sampled. Information on the structural orientation, gold concentration, vein thickness, alteration, and host rock type of the veins was recorded. Mean gold concentration for each vein set was calculated using the Sichel's t estimator method [1,2]. This information was then set in context to geological parameters such as structural characteristics of the host units, vein orientation, vein thickness, alteration, and host rock type.

Three areas in the mine were sampled. The Eastern Pushback (EPB) is situated in the Spes Bona Member of the lower Arandis Formation and exhibits veins of the main shoot. The North Pit 2 area (NP2) is located in the Spes Bona Member, too, but exhibits veins of the second shoot. The Upper Schist area (US) is located in the Oberwasser Member of the upper Arandis Formation, exhibiting veins of the main shoot. In the EPB, three major vein sets are developed. The EPB-1 veins dip at shallow to intermediate angles (~20°) to the NE and yielded a mean concentration of 24.7 ppm Au. The EPB-2 veins dip at shallow to intermediate angles (~40°) to the E and have a mean concentration of 7.5 ppm Au. The EPB-3 veins are oriented parallel to the bedding and dip at steep angles (~70°) to the WNW. Their mean gold concentration is 1.3 ppm. In NP2, NP2-1 veins dip at shallow to intermediate angles (~40°) to the NE (mean gold concentration 16.3 ppm), NP2-2 veins are oriented at shallow to intermediate angles (~40°) to the NNW (mean gold concentration 3.8 ppm) and NP2-3 veins dip at steep angles (~80°) to the ESE (mean gold concentration 2.1 ppm). In the US area, one major vein set (US-2), dipping at shallow to intermediate angles (~30°) to the NE, is the only mineralized vein set and has a mean gold concentration of 9.5 ppm. A number of subordinate vein sets occur in the US area, which may pre- or post-date the mineralized veins. In all locations, the veins are more highly mineralized than the adjacent alteration zones. No correlation between the gold grade and the vein thickness, alteration, or host rock type could be found.

The results of this study indicate that it is the structural orientation of the veins that has an influence on their gold grade. Vein sets oriented at a high angle to the bedding seem to be better mineralized than veins oriented at a low angle to the bedding. The reason for this is interpreted to lie in the fact that veins

oriented at high angle to the bedding coincide with planes of preferred fracturing oriented at ~ 30-40° to σ_1 and are thus more favorably oriented to the stress field e.g. [3]. Veins oriented favorably to the stress field may propagate faster and therefore create more vein volume per time unit. This may be conducive to induce a pressure drop and related phase separation in the fluid entering the vein and lead to an enhanced precipitation of gold.

References:

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