Gold-copper fertile intrusions in the Hualgayoc mining district, Peru

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The Hualgayoc mining district consists of weakly deformed Oligocene sedimentary rocks with minor intrusions, and various sulfide veins and dikes. These formations were intruded by western Miocene dioritic bodies including Cerro Corona, and overlaid by andesitic to rhyolitic flows, domes and tuffs. The AntaKori and Tantahuatay deposits are partially hosted in the Calypso volcanic formation in the western part of the district, southwest of the San Miguel diorite. The Cerro Corona porphyry intruded Oligocene limestones, west of Cerro Jesus and Cerro San Jose intrusions, which host historic relicts of base-metal intermediate sulfidation veins

3 Lithology and alteration

The dominant phase of intrusions in the Hualgayoc mining district consist of hornblendic-hornfels-bearing, porphyry-style, andesitic-magnetite megacrysts, indicating relatively oxidized parental magma. This includes Cerro Corona, the Coyomolache sill, the San Miguel diorite and the San Nicolas. Cerro Jesus and Cerro San Jose intrusions

Lithology and alteration

The Hualgayoc mining district is located in the Andean Cordillera of northern Peru, 36km north of the Yanacocha high-sulfidation Au district. The district hosts numerous Au-Cu deposits, including the Cerro Corona Au-Cu porphyry, the Tantahuatay high sulfidation Au, and the Antakori skarn/high sulfidation Au-Cu deposits. In this study we characterize the igneous rocks in the Hualgayoc mining district and identify the features associated with Au-Cu fertile magmas

4 Zircon textures

Zircon is a common accessory mineral in most intrusions. The grains are euhedral with a yellow-brown color. Most grains range from 50µm to 300µm and commonly contain spessartite and felty lamellae. All zircons show typical magmatic oscillatory zoning, and common sector zoning. Internal cores are present but rare, and are often found so far in zircons from Cerro Corona and cerro Huayllay

5 Bulk rock composition

All intrusions except Cerro Quijote show an "adakite"-like signature with high Sr/Y (40-100) and low Y (5-10ppm) (Fig. 6). This can be explained by high water contents in parental magmas (>14 wt% H2O) that suppress plagioclase crystallization (Slonon and Grove, 1993). This is consistent with the presence of biotite and hornblende phenocrysts in most intrusions. Samples from Cerro Corona, which host the Au-Cu deposit, are among the highest Sr/Y and Ce/Ce* in zircon, along with Cerro Chorro Blanco and Cerro Cuadrada (Fig. 6). Oxidation condition does not seem to correlate with magma evolution, suggesting that the magmas were intrinsically oxidized (Fig. 6). Low Lu/Yb ratio (1-2) of most intrusion indicate that these rocks are not adakitic, partial melt of the subducting slab with a garnet residue (Fig. 6)

6 Implications for exploration

The range of intrusions in the district was not previously uncertain, with some suggestion of at least Escocene to Miocene ages. This study showed that the dated range from ~14.8Ma to ~9.7Ma, similar to the ages of igneous and hydrothermal activity of the Yanacocha high-sulfidation Au district. Most intrusions formed in a ~1 m.y. period between 14-13Ma. Some are associated with mineralization (Cerro Corona) while others appear to be barren (Coyomolache). Late magmatic activity ranged from 14.8Ma to 9.7Ma, similar to the ages of igneous and hydrothermal activity of the Yanacocha high-sulfidation Au district. Most intrusions formed in a ~1 m.y. period between 14-13Ma. Some are associated with mineralization (Cerro Corona) while others appear to be barren (Coyomolache). Late magmatic activity ranged from 14.8Ma to 9.7Ma, similar to the ages of igneous and hydrothermal activity of the Yanacocha high-sulfidation Au district. Most intrusions formed in a ~1 m.y. period between 14-13Ma. Some are associated with mineralization (Cerro Corona) while others appear to be barren (Coyomolache). Late magmatic activity ranged from 14.8Ma to 9.7Ma, similar to the ages of igneous and hydrothermal activity of the Yanacocha high-sulfidation Au district. Most intrusions formed in a ~1 m.y. period between 14-13Ma. Some are associated with mineralization (Cerro Corona) while others appear to be barren (Coyomolache). Late magmatic activity ranged from 14.8Ma to 9.7Ma, similar to the ages of igneous and hydrothermal activity of the Yanacocha high-sulfidation Au district. Most intrusions formed in a ~1 m.y. period between 14-13Ma. Some are associated with mineralization (Cerro Corona) while others appear to be barren (Coyomolache). Late magmatic activity ranged from 14.8Ma to 9.7Ma, similar to the ages of igneous and hydrothermal activity of the Yanacocha high-sulfidation Au district. Most intrusions formed in a ~1 m.y. period between 14-13Ma. Some are associated with mineralization (Cerro Corona) while others appear to be barren (Coyomolache). Late magmatic activity ranged from 1