An unusual example of the interaction of a modern hydrothermal system with Au-Ag veins (South Kamchatka)

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The Rodnikovy hydrothermal near-surface Au-Ag deposit is situated in the upper waters of the River Vilucha at a distance of 60 km from Petropavlovsk-Kamchatsky. Subvolcanic diorites (remains of a subterranean volcanic chamber) of Pliocene-Pleistocene age are host rocks. The ore bodies form a series of vertical or steeply dipping veins with a thickness of 0.5–6m that can be observed for distances up to 1km. The ores are of low sulphide type, and have the following mineral composition: native Au and Ag, argentite, stibioperceite-arsenoplibzite [undefined] (with Se 0.0-2.5%), sulphosalts, sphalerite, hessite, marcasite, galena, chalcopyrite and pyrite. Ore minerals amount to 3–5% or less. Nonmetallic minerals are calcite, quartz, adularia, chlorite, sericite etc.

About 1.2 km East of the veins are hot springs, the Vilucha Hot Springs, and drilling in the east flank of the deposit found hot hydrothermal waters (95–98°C). When a drift adit was dug, a high temperature zone (60–75°C) and several hot springs (70–90°C) were encountered. In Winter, when there is little meteoric water, sulphites are deposited, and these together with other minerals such as gypsum, epsomite, anhydrite, phosphates and carbonates sometimes enriched in Hg, Ag and Au form snow-like aggregates on the adit walls. In Summer, when there is more meteoric water, it becomes a 'hydrothermal spring'.

On primary Au-Ag-containing ore surfaces, quartz-calcite-adularia coatings have been found together with single crystals of proustite and xanthoconite that are not found in the primary ores. Beneath these coatings, the changes in primary mineral composition can be seen, and are accompanied by selenide and telluride formation and by the appearance of complex oxides containing Tl, Pb, S, Fe, As, and Se that have not been identified. In the hot waters, high concentrations of Sb and Ge have been detected. This unique natural laboratory could provide opportunities for the investigation of ore forming processes and regeneration.