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Application of X-Ray Computed Microtomography for Quartz-Sulfide Stockwork Study: Drazhnoye Gold Deposit (Yakutia, Russia)

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The Drazhnoe orogenic-type gold deposit is located in Yakutia, Russia. Several gold-bearing stockwork systems within the NNW left-lateral shear zone were explored. To study the relationship of the geologic elements of the stockwork, half of the drill core sample was studied using the X-ray computed tomography method (CT). The drill core sample is 20 cm long and 6 cm in diameter. The sample was scanned by a medical tomograph at two energy levels (80 and 130 keV). Postprocessing of CT data made it possible to obtain a reliable distribution of minerals in the sample. As a result of the study, we obtained a detailed stereological model (tomogram) that allowed us to isolate quartz and quartz-carbonate veins, to divide sulfide mineralization into pyrite and arsenopyrite, and also to isolate gold (Fig. 1A). As a result of the analysis of both the sample and the obtained tomogram, all the selected veins and sulfide mineralization were divided into generations. After that, every generation of each mineral was analyzed and, considering all the revealed structural relationships and knowledge about the mineralogical composition of mineralization, we distinguished the structural and mineral paragenesis into various stages and substages:

Stage 1 (pre-mineralization). Quartz veins were formed in horizontal compressional stress conditions.

Stage 2 (mineralization). The mineralization stage, at early substage, was characterized by the formation of metasomatic pyrite and arsenopyrite in terrigenous sedimentary rocks. These sulfides are controlled by cleavage and bedding and they also fill the microfractures. At this substage, veins were also formed in horizontal compressional stress conditions (Fig. 1B).

During the second substage, gold-bearing quartz-carbonate-sulfide veins were formed. These veins crosscut previously formed structures (Fig. 1B). Native gold grains are associated with large quantities of early pyrite and arsenopyrite and are also localized in quartz-carbonate-pyrite veins.

During the final, third substage, flat-dipping veins with coarse-crystalline quartz were formed. The older structures are intersected by the veins. In some sections of the deposit, such veins are gold-bearing.

As a result of the study, the stereological models for each stage and substage of mineralization were created. This made it possible to study the distribution of minerals in the core, to investigate the morphology of the selected structures, and to make a kinematic interpretation of their formation. This contributes to developing a more detailed, realistic, and reliable three-dimensional model of the deposit.

Fig. 1. A -general view of the half core sample that has been examined and its stereological model; B - stereological models of selected stages and substages; in the orange frame - detailing the location of native gold.