

## GENERAL OVERVIEW OF THE PHOSPHATNO-ARSENATNAYA VEIN

The quartz-sulfide vein, later named the Phosphatno-Arsenatnaya vein, was opened at the Southern area of the open pit using a series of explosions in November and December of 2023, and then again in March and May of 2024 (Fig. 4).

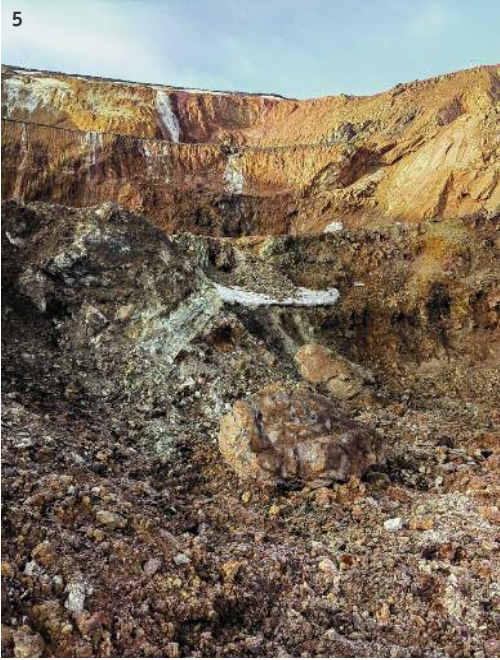
According to our observations, the vein is approximately 30 m long. It strikes S-N and dips steeply (70°) westward (Fig. 5). The top of the vein is in contact with a weathering crust composed primarily of red clays while the vein itself is hosted by strongly schistosed siltstones (Fig. 6). The highest producing and most mineralized portion of the vein contains high-grade oxidized ores that occur from +249 to 230 m above sea level, the vein thickness ranges from 1 to 8 m. Below 230 m, the vein becomes pure quartz and its dips at a gentler angle (40°). At 220 m, the vein thickness increases up to 30 m and assumes a lens-like morphology. Only goethite (limonite) and malachite were identified among supergene minerals at this lower site. In the period of July to September 2024, the mining company installed a water collection sump at 220 m level; therefore, mining was stopped, and further observations of the nature of the vein became impossible (Fig. 7).

The vein is primarily composed of grayish white massive quartz with veinlet-disseminated sulfide mineralization (chalcopyrite and galena) which formed at the second stage of hydrothermal alteration. In the middle and upper parts of the vein, these minerals are overprinted by later beige massive quartz, which in turn, is recrystallized with

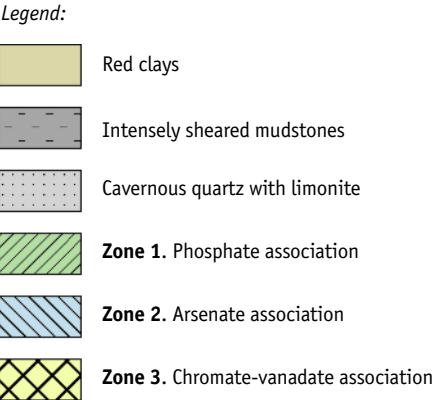
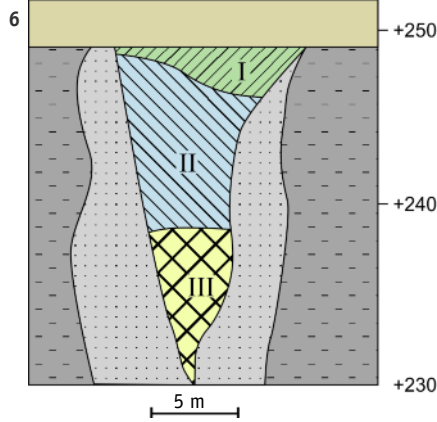
4. Location of the Phosphatno-Arsenatnaya vein (marked by red ellipse) in the open pit of the Murzinskoe deposit. March, 2024. Photo: Nikolai V. Bail.



5. Phosphatno-Arsenatnaya vein, March, 2024. FOV: about 10 m. Photo: Vladimir S. Lednev.



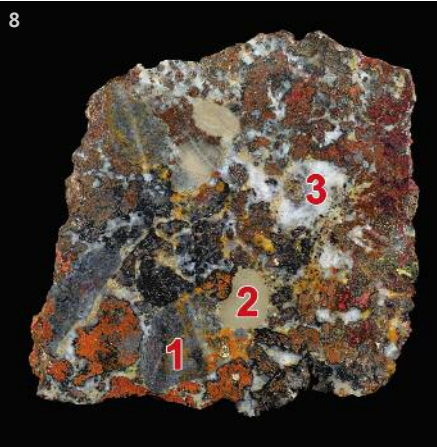
6. Sketch of the Phosphatno-Arsenatnaya vein (section). The altitude above sea level is shown on the vertical axis.



7. Water sump at level +220 m. Open pit of the Murzinskoe deposit, Southern area. Red dotted line shows thickening of the Phosphatno-Arsenatnaya vein that transitions to quartz lens. May, 2024. Photo: Vladimir S. Lednev.



8. Polished fragment of the Phosphatno-Arsenatnaya vein showing different generations of quartz: (1) grayish white with sulfide inclusions, (2) beige massive, (3) colorless and milky-white. (1) to (3) are associated with red and red-brown iron oxides and black manganese oxides. 13 x 13 cm. **Zone 2**, level +245 m. Specimen: Vladimir S. Lednev. Photo: Maria D. Milshina.



latest colorless and milky-white quartz, which form druses of crystals up to 5 x 1 cm in size in cavities (Fig. 8). Ore mineralization includes arsenopyrite and tennantite and at the deepest levels, sphalerite is observed. Parts of the vein are strongly limonitized, especially in the upper part where ochre is observed. Ore minerals are highly oxidized and in some places are completely replaced by secondary minerals (Figs. 9, 10, 101), hence assignment of the

Phosphatno-Arsenatnaya ores to an oxidized ore type. Primary sulfides and sulfosalts are observed only as relics. The oxidized part of the vein is clearly **vertically** zoned. Detailed *in situ* observations conducted over a six month period, coupled with instrumental analyses of the samples, allowed identification of **three zones** (assigned as 1, 2, and 3); each zone has a specific mineral association (Fig. 6).