Geology, mineralization and geochemistry of Tak I, Taknar polymetal massive sulfide (Cu-Zn-Au-Ag-Pb) deposit, Khorasan- Bardaskan

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Abstract: Rock unites which are exposed in Tak-I mine area are: Taknar formation (Ordovician), Mid-late Paleozoic and younger intrusive rocks. Taknar formation consists of sericite schist, chlorite schist, chlorite-sericite schist and some meta-diabase- gabbro-diorite. Taknar Polymetal (Cu-Zn-Au-Ag-Pb) Massive sulfide deposit formed at certain horizon of Taknar formation. Three style of mineralization are: stockwork, layered and massive. Due to strong tectonic activity in the area, dimension and geometry of deposit are being changed. Paragenetic minerals within the massive and layered are: magnetite + pyrite + chalcopyrite ± sphalerite ± galena ± sulphosalt ± gold + chlorite ± carbonate ± sericite. Magnetite is the main mineral in the massive zone. Paragenesis within stockwork are: pyrite + chalcopyrite ± magnetite + chlorite + quartz + sericite ± carbonate. Based on mineral paragenesis, the ore bearing solution had the following condition: \( T \geq 270 \degree C, \) \( \text{pH}=5 - 7, \) \( \log fO_2 = (-29) \text{ to } (-30) \). Also, The range of chemical composition of some elements within Tak-I massive sulfide is as follow:
\[ \begin{align*}
    \text{Cu} & = 0.01 - 5.86 \% \\
    \text{Zn} & = 269 - 15600 \text{ (ppm)} \\
    \text{Pb} & = 27 - 4400 \text{ (ppm)} \\
    \text{Au} & = 0.86 - 7.53 \text{ (ppm)} \\
    \text{Ag} & = 2.4 - 95.1 \text{ (ppm)} \\
    \text{Bi} & = 34 - 2200 \text{ (ppm)}
\end{align*} \]

Based on the paragenesis, alteration, style of mineralization, petrography, geochemistry, and structure, Tak-I is part of massive sulfide deposit. Due to high content of Cu, Zn, Au, Ag and Pb, Taknar massive sulfide deposit is a polymetal deposit. Based on high magnetite within sulfides and lack of pyrrhotite, Taknar is a special massive sulfide deposit.

Keywords: Taknar deposit, Massive sulfide, Polymetal mineralization.