The emersion and crystallography of erythrite (Co$_3$(AsO$_4$)$_2$8H$_2$O), discovered in Tarikdarreh area, NE Iran

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Abstract: Erythrite (Co$_3$(AsO$_4$)$_2$8H$_2$O) is one of the rare arsenic minerals which belong to the vivianite group. A recent discovery in Tarikdarreh prospect area (northeastern Iran) found erythrite along with scorodite and hydroxides of iron have been recognized as a supergene alteration product of primary arsenic mineral in surface arsenopyrite ± pyrite mineralization veins zones. A specimen of erythrite has pale red to shiny pink color and aggregates to form into a bright red color star with a radial structure. When observed under a microscope it is elongated in C crystal axial with pleochroism. This mineral has a monoclinic system, space group C2/m and the unit-cell parameter constants are $a = 10.251$, $b = 13.447$, $c = 4.764$, $\beta = 104.98$. The crystalline structure of this mineral forms chains of tetrahedral of arsenic, octahedra of cobalt-iron which bind with oxygen and hydrogen. Scanning electron microscope images of this crystal exhibit a timber shape and SEM-EDX analysis have confirmed As, Co elements in this crystal structure and chemical composition. An XRD examination reveals arsenopyrite as the main sulphide phase in the mineralization zone and analysis by ICP-Mass have shown that they have high levels of cobalt element. Surface weathering of arsenopyrite has provided aqueous species of cobalt and arsenide for crystallization erythrite. On the other hand erythrite can only be stable in the range of 6 to 8 pH conditions, and then Eh-pH condition has an important role in controlling the stability and solubility of erythrite.

Keywords: Erythrite; arsenopyrite; cobalt; scorodite; Tarikdarreh.