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A FLUORITE-CALCITE MINERALIZATION AT WADI UM ESH EL ZARQA, CENTRAL EASTERN DESERT, EGYPT

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ABSTRACT

A fluorite-calcite mineral association is to be reported and studied to the first time at Wadi Um Esh El Zarqa in the central Eastern Desert. This is a fissure filling vein deposit occurring in a country of dioritic and amphibolitic rocks. The vein is trending generally N—S and is 1.20 ms width and about 400 ms in length. The fluorite has a mean specific gravity of 3.16, while the calcite has an average gravity of 2.72. The fluorite is altered to calcite. It is shown that the investigated flourite is formed most probably during a main pneumatolytic process and not during a hydrothermal phase.

INTRODUCTION

A fluorite-calcite mineral association is occurring at Wadi Um Esh El Zarqa east of Wadi Atalla El Murr which is an eastern branch of the main Wadi Atalla. It is located at about 15 kms to the north of El Fawakhir Gold Mine on the Qift-Qusseir asphaltic road in the central Eastern Desert of Egypt. It lies at the intersection of longitude 33° 37 E with latitude 26° 08 N.

As a matter of fact, recorded fluorite occurrences in Egypt are relatively few in number and the study of fluorite mineralization did not receive adequate attention up till now.

HUME [1937] stated that fluorite is found in talc schists adjoining tin-bearing quartz veins situated at about six kms to the north east of Gebel Muweilih. SADEK [1953] reported the presence of fluorite in small quantities in quartz veins in the gneisses of Wadi Sikait belonging to Wadi Gemal area in the south Eastern Desert. ABDEL NASSER and CHUKRI [1954] during their prospecting and exploration in south Sinai found a small fluorspar vein near Wadi Seih Sidri surrounded on both sides by a white calcite vein.

MOUSTAFA *et al.* [1954] recorded some fluorite mineralization occuppying the middle part of quartz veins cutting through the Pink-red granite mass of Gebel El Ineigi. This fluorite is associated with few scattered grains of galena and minute specks probably of chalcopyrite. AMIN [1955*a*, *b*] mentioned the presence of fluorite either as separate veins or as one of the constituents of the mineralized veins in association with the tin = tungsten deposit in Wadi Igla. EL SHAZLY [1957] considered the tin-tungsten veins-with the associated fluorite mineralization-such as that at El Muweilha locality, to be of the hypothermal call among the true hydrothermal fissure veins of a late precambrian age.

MOHARRAM *et al* [1970] reviewed the ststus of fluorite occurrences in Egypt and referred to its presence at El Ineigi and Igla localities. EL SOKKARY [1970] reported the presence of fluorite as accessory mineral associated with some pink-red granites in the Eastern Desert and Sinai peninsula. Other minor occurrences are said to be

reported in other localities of the Eastern Desert e. g., Homret Akarem and Homret Waggat.

The present work represents the first detailed investigation on the fluorite-calcite mineralization at Wadi Um Esh El Zarqa from the geological and mineralogical points of view.

GEOLOGICAL SETTING

The fluorite occurs banded with calcite in a manner that fluorite is in contact with country rock. The two mineral association forms a fissure vein deposit of about 1.20 m width with a surface exposure of about 400 m in length. It is emplaced along a fault zone of some two km extension and about 10 m width of alteration. The fault is trending generally N—S and is steeply dipping (60°—70°) to the east. It is passing through a country of dark greyish green, medium grained dioritic rocks and granitized amphibolites that are intruded by numerous dykes of aplites, felsites and microgranites beside numerous quartz veins. The lower parts of the amphibolite are highly foliated with a trend of foliation roughly running N—S.

There is a sort of quartz body taking a lensoid shape, extending about five meters in length and has a variable thickness ranging between 50—150 cm and taking a N—S direction. It is milky white in color, but tends to be reddish and striated on the fractured and weathered surfaces.

Field measurements of gamma radioactivity by a scintillometer gave a range from 6—8 μR/h for amphibolites while the mineralized vein gave an activity from 10—12 μR/h. It is seen that the mineralized vein shows a slightly higher activity than that of the surrounding rocks.

MINERALOGICAL INVESTIGATION

This occurrence consists of apple green fluorite occupying a band of about 8—10 cm thick. The color varies from deep apple green to paler shades and sometimes almost colorless. The fluorite crystals form aggregates that are massive. Individual crystals can reach up till 2.5 cm in length. Associated with this fluorite, there are some calcite which sometimes take the form of small veins or veinlets of about 0.7 cm thick. The latter follow cracks and fissures in the fluorite and hence calcite is later than fluorite in its paragenetic sequence. Veins and veinlets may be straight or irregular. The rock is subjected to intense cracking and hence to deformation.

Fluorite crystals are sometimes observed to give reaction with HCl which means that they are associated with fine calcite particles probably occupying very thin veinlets, a matter which may prove that calcite is an alteration product of the fluorite. CLARKE [1959] states that fluorite alters into calcite, being attacked by percolating waters containing calcium bicarbonate or alkaline carbonates.

Specific gravity measurements are done on eight separated samples of fluorite crystals and gave a range of 3.14—3.18 with an average of 3.16. This average is close to that of crystallised fluorite which is 3.18 [DANA, 1949]. However the slight lowering of specific gravity of the investigated fluorite may indicate its alteration to a limited extent.

Calcite band on the other hand occupies about 5 cm in width. It is composed of massive well crystallised calcite with almost white color tinted with pale violet shades. Most of the crystals have an average size of about 3 cm but some can reach up till 4 cm. Calcite crystals develop good rhombic cleavage. They give strong and instantaneous effervescence with HCl proving that they are calcite and not dolomite.

The calcite block contains small veinlets always along cracks that are full with dark and hard material which does not give always positive reaction with HCl and may be in its most part silica (quartz).

Another eight measurements of specific gravity are done on some separated crystals of calcite. They gave a range of 2.72—2.74 with an average of 2.72 which is close to that of pure crystallised calcite with specific gravity of 2.71 [DANA, 1949]. Under ultraviolet light, fluorspar shows a characteristic deep violet fluorescence, while calcite glows with a brilliant rosy fluorescence.

Specks of steel black galena are present occupying small fissures in the fluorite. They give the smell of H_2S on treating with HCl. Thus galena, like calcite, follow fluorite in the paragenetic sequence, but its relative order to calcite is not quite clear.

DISCUSSION

The fluorite-calcite mineral association is present in the form of a vein which is emplaced along a fault zone trending generally N—S. This vein is running into a country of dioritic and amphibolitic rocks. Whenever these rocks are foliated, they take a trend of foliation roughly running N—S. The vein is thus originally occupying preferentially a prominent foliation plane in the surrounding country rocks which was augmented later by faulting. Therefore, this type of vein is most probably of the fissure filling type.

The slight increase of the radioactivity of the vein over that of the surrounding rocks might indicate that the material of the vein, at least partly, is not from quite extranaceous sources. Possibly the original basic country rocks had provided the necessary Ca for making the fluorite during an alteration process. If this alteration occurs during a pneumatolytic phase accompanied by fluorine emanation, then fluorite will be formed. This pneumatolysis is justified since the country rocks were subjected to granitization and intrusion of numerous acid dykes i.e. they were subjected to igneous activity. Later on, the fluorite partly gave to calcite by alteration. Thus fluorite here is formed most probably during pneumatolysis and not during a hydrothermal phase. CLARKE (1959) mentioned that fluorine compounds are especially characteristic of the deep-seated or plutonic rocks, where the gaseous exhalations have been retained under pressure, and are commonly regarded as of pneumatolytic origin.

However, a later mobilizing hydrothermal phase can be postulated, following the main pneumatolytic process, which might be responsible for filling the fissure vein. DEER *et al.* [1972] mention that in the igneous fluorite occurrences associated minerals include cassiterite, topaz, apatite, lepidolite, etc., for the pneumatolytic deposits and calcite, pyrite, apatite, etc., for the hydrothermal product. The same authors add (p. 513) that fluorite is often found associated with typical hydrothermal minerals not known to be directly related to any igneous body. Such hydrothermal vein deposits may also carry barytes, sphalerite, galena, calcite and chalcedony or quartz.

Accordingly, the presence of calcite, galena and quartz in association with the investigated fluorite may indicate the possible presence of a hydrothermal phase involved in its formation.

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