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# ON SOME GARNETS FROM THE PEFKI DISTRICT PEGMATITES (PARANESTI - N. GREECE)

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**Abstract:** *Garnets from the muscovite pegmatite occurrences of Pefki district (Paranesti-N. Greece) are studied on the basis of their chemical composition. From the three microprobe analyses it resulted that they have an almandine-spessartime composition. These garnets are probably of magmatic origin and they appear in the wall area of the pegmatite body.*

## 1. INTRODUCTION

The garnets described in the present study selected from pegmatites of Pefki area belong to the large pegmatitic occurrences of the "Paranesti granite" area (N. Greece). These pegmatites, studied by SKLAVOUNOS (1981), appear as dykes medium to coarse grained and constitute of quartz, K-feldspar and muscovite. The garnet crystals are distributed in the contact area of the pegmatite dyke and the surrounding granitic rock. They are often rounded and almost free of inclusions. The observed crystals are up to 0.5 mm in size and fractured. They display as reddish-brown macroscopically and colourless in thin section. In few cases muscovite crystals are found sticking tangential to garnet grain boundaries.

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## CHEMISTRY AND MAGMATIC ORIGIN OF GARNETS

For the specific identification of the garnets studied, it is necessary to determine their chemical composition. The microprobe analyses of three garnet samples are reported in Table 1 together with their recalculation on the basis of 24 (0) and the distribution into the molecular percentage of their end-member components following RICKWOOD (1968).

The microprobe analyses have been performed by the author, in the I.G.M.E. laboratories (Athens, Greece) using the wavelength analysis system of a JEOL 733 microanalyzer with automatic correction. Each analysis reported in Table 1 is the mean of ten point analyses on each analyzed garnet crystal. Besides for the identification of a possible zoning in the analyzed crystals, x-ray images for the major elements were taken. From the distribution of the elements on the analyzed surface of the crystal no compositional zoning was observed.

As it is seen in the the analyzed garnets, almandine is the main component followed by spessartine with a small participation of pyrope and grossular. DEER et al (1982) refer that almandine garnets, typically found in small amounts in granite aplites and pegmatites, are generally fairly rich in the spessartine molecule and commonly have an intermediate composition in the almandine- spessartine series. AHMED and AHMED (1975) in their study on garnets of different rock types from Pakistan, report garnets with similar composition to the minerals of the present study, as typical pegmatite garnets. HSU (1968) supports that almandine garnets rich in spessartine molecule, are probably of magmatic origin. The same author suggests a spessartine thermal stability field that demonstrates the absence of a physical restriction which could inhibit the crystallization of this mineral from magmas. The magma chemical composition is the decisive factor controlling the appearance of spessartine; magmas initially contain very little manganese, so it is only near final stages of crystallization that concentrations of manganese become high enough to favor production of spessartine. ALLAN and CLARKE (1981) in their study on garnets from the South Mountain Batholith-Nova Scotia, believe that garnets from aplites with such manganese content are probably of igneous origin. GREEN (1977) accepts the garnet composition as a possible indicator of crystallization of silisic igneous rocks, that is the considerable effect of MnO in stabilizing garnet in silisic liquids to shallower levels. Especially garnets with 10% mol spessartine, are considered as stable in silisic liquids at 5 kb or less. The plutonic complex of Paranesti granite of which part are the pegmatites of Pefki, as is assumed from the mineralogical and petrological data (SKLAVOUNOS 1981) as well as the geology of the area (contact phenomena), belongs to the calc-alkaline magmatic rocks. From all the above it is concluded that the garnets from the Pefki pegmatites are of magmatic

origin and have the typical composition (almandine-spessartine) of garnets from pegmatites.

## RELATIONSHIP OF GARNET COMPOSITION AND POSITION WITHIN THE PEGMATITE BODY

There are many regardings about the relationship of the chemical composition of pegmatite garnets and their position the pegmatite body and the surrounding rocks. BALDWIN and KNORRING (1983) in their study on pegmatite garnets from Africa, North America and Finland, established a relationship between garnet composition and zones in large complex granitic pegmatites. For these authors the garnet composition varies according to its position within the pegmatite body. That is a district tendency for the late-formed garnet, in replacement zones and zones surrouing the core, to be richer in manganese and poorer in iron. Conversely, there is a district tendency for the earliest-formed garnet, in contact and wall zones to be poorer in manganese and richer in iron. For the crystallization conditions of the pegmatite garnets, Baldwin and Knorring accept also that spessartine and almandine garnets are stable thoughout the temperature range of granite-pegmatite consolidation. Divalent manganese is concentrated at the late stage of crystallization of pegmatite owing to its large ionic radius relative to that of the other divalent elements of the Mn-Fe group. Almandine-spessartine garnet crystallizes early in the wall and contact zones; in comparison spessartine garnet crystallizes later either at the edge of the core or in the replacement zones. A general pattern of manganese concentration in garnet relative to the pegmatite zones was constructed by the above authors. This pattern concerning the various garnets studied by them, as well as the corresponding values of the present study, are illustrated in Fig. 1. From the plotting of the values of the Pefki pegmatite garnets it is obvious that they show the same behavior as regards the chemical composition and their position in the rock.

We can conclude that the garnets from the pegmatites of Pefki display a composition of the typical garnet from the wall zone of the pegmatite body.

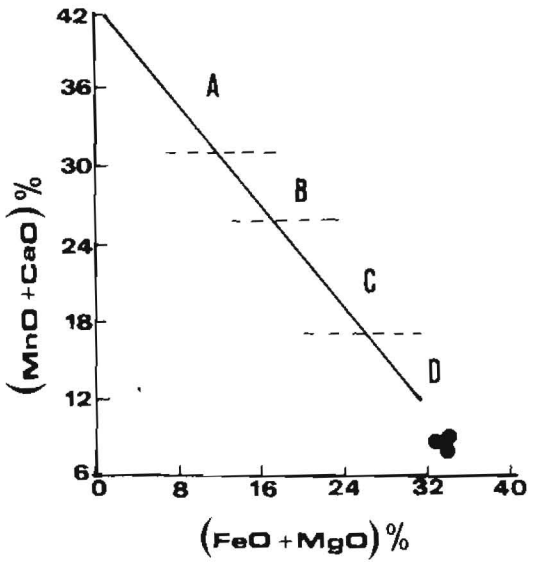


Fig. 1. Relationship between the chemical composition of garnet and pegmatite zones. A = Core and replacement zones (Lithium pegmatites) Mn-rich Garnets. B = Core and replacement zones (Lithium-deficient pegmatites) Mn-Fe Garnets. C = Intermediate zones Mn-Fe Garnets, Fe-Mn Garnets. D = Contact zones Fe-Mn Garnets. • = Garnets from Pefki pegmatites.

Table 1. Microprobe analyses of garnets.

| | | | |
|---|---|---|---|
| $SiO_2$ | 36.90 | 37.21 | 36.59 |
| $TiO_2$ | 0.25 | 0.29 | 0.06 |
| $Al_2O_3$ | 20.68 | 21.01 | 20.78 |
| FeO | 31.58 | 31.03 | 32.42 |
| MnO | 6.55 | 6.43 | 6.80 |
| MgO | 1.65 | 1.72 | 1.51 |
| CaO | 1.81 | 1,82 | 1.62 |
| Total | 99.42 | 99.51 | 99.78 |
| Recalculation on the basis of 24(0) | | | |
| Si | 6.020 | 6.038 | 5.979 |
| Al | - | - | 0.021 |
| Al | 3.976 | 4.018 | 3.982 |
| Ti | 0.031 | 0.036 | 0.007 |
| Mg | 0.402 | 0.415 | 0.369 |
| $Fe^{+2}$ | 4.309 | 4.211 | 4.430 |
| Mn | 0.905 | 0.884 | 0.941 |
| Ca | 0.324 | 0.316 | 0.284 |
| Molecule percentage of end member molecules | | | |
| Almandine | 73.21 | 73.19 | 73.47 |
| Spessartine | 14.94 | 14.66 | 15.68 |
| Pyrope | 6.62 | 6.90 | 6.12 |
| Grossular | 5.22 | 5.25 | 4.73 |

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# ΜΕΛΕΤΗ ΠΑΝΩ ΣΕ ΓΡΑΝΑΤΕΣ ΑΠΟ ΠΗΓΜΑΤΙΤΕΣ ΤΗΣ ΠΕΡΙΟΧΗΣ ΠΕΥΚΗΣ (ΠΑΡΑΝΕΣΤΙ - Β. ΕΛΛΑΔΑ)

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