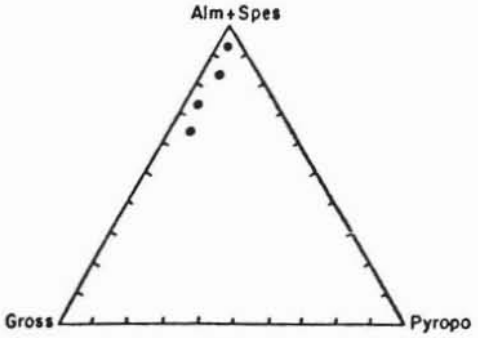

Fig. 2

enclosed within garnet-bearing schists, orientated towards the same direction. This association generates some metamorphic enclaves. Both, enclaves and host rocks are transformed by subsequent feldspathization processes, originating «lit par lit» structures.

The intrusion was synchronical with the principal Hercynian tectonic phase described for this zone.

These granitic rocks correspond to leucogranites with quartz, microcline, plagioclase, as well as to smaller amounts of muscovite ±, biotite ±, turmalire ± garnet. They can be defined as «S» types, representing the most evolved cal-alkaline series in the Iberian Plateau.

Garnet analitical determinations show great proportions in almandine-spessartine (Fig. 2), typical of per-aluminic granitic series. The geological, petrological and geochemical data appear to indicate a close realtionship between the emplacement of these later granitic masses and the origin of the garnets.

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APONTE F.*, BALASSONE G.*, BONI M.*, COSTAMAGNA L.*, DI MAIO G.* - *The Hercynian skarn ores in SW Sardinia: their relationships with the lower paleozoic MVT deposits*

In SW Sardinia are well known some skarn occurrences, resulting from the conctact-metamorphic phenomena related to multiple intrusions of hercynian granites. The intruded and metamorphosed rocks are Cambrian and Ordovician sediments, often containing stratabound ore deposits of Mississippi Valley type. Very frequently to the skarn are also related some small ore bodies whose main metallic content is as follows: Fe, Zn, Pb, Cu, Ba, F. Only Cu and F are not to be found in the Cambrian and Lower Ordovician metallogenesis. There are traces of Bi W, Sb, Ag and As. In this preliminary study we will consider only three main occurrence areas with distinct characteristics: 1) Fluminese; 2) Oridda; 3) South Eastern Sulcis.

1) Fluminese (Su Zurfuru, Gutturu Pala, S. Lucia)

In this area outcrop mostly the Gonnesa Fm limestones and the Cabitza Fm slates, both in contact with the Ordovician clastic sediments.

Actually there are no granites outcropping, but a small apex might be present underneath the Su Zurfuru mine. The control of the skarn phenomenon is both stratigraphic and tectonic: when the two effects are superimposed, the skarn are particularly well developed. At Gutturu Pala the thermal metamorphic effects are restricted mostly to the metallic minerals. At Su Zurfuru and S. Lucia we can observe higher temperature paragenesis, ranging from real skarns to hydrothermal veins. We can distinguish between metamorphic skarn and vein skarn. In the metamorphic skarn there are: Ca-garnet, hedembergite, chlorite, epidote, quartz and calcite, with less wollastonite, diopside and actinolite. Metallic minerals consist of: pyrite, sphalerite, galena, chalcopirite and magnetite with less marcasite, pyrrotite, haematite and sulphosalts. In the vein skarns we have two distinct association: a) hedembergite, chlorite, quartz, calcite and b) wollastonite, chlorite, epidote. The ore minerals are mostly galena, pyrite, marcasite and heamatite. The general paragenesis shows that the first minerals to be formed are wollastonite, hedembergite, garnet and diopsite, followed by a hydrothermal phase, to which the ore deposition is ralated, with chlorite, epidote, fluorite, calcite, quartz, barite (and in Su Zurfuru the extremely rare mineral armenite).

2) Oridda (Perda Niedda, Tiny, Sa Duchessa)

In this area the most important geologic features are the karstified contract between the Gonnesa Fm and the Ordovician clastic sediments, often acting as channelways for the metamorphic fluids, as well as some important tectonic lines. We should point out, however, that in the whole region a shallow degree of thermal metamorphism is always present, as observed in the ore minerals association (Barrasciutta, Perdu Carta, Reigraxius). At higher temperatures we can distinguish between barren (vein) and mineralized (mostly metamorphic) skarns. In the first case the mineralogical association is: Ca-garnet, tremolite, epidote, chlorite. In the second we have different types in relation to the originary lithology, the nature of the fluids and the importance of the late hydrothermal phase. At Tiny and P.ta Nebidedda the paragenesis contains Ca-garnet, wollastonite, andalusite, chlorite, sericite, quartz, calcite, dolomite. The ore minerals consist of galena, sphalerite, pyrite. At Perda Niedda and Sa Duchessa we have a lower temperature paragenesis: sericite, chlorite, quartz, calcite, fluorite and relicts of altered amphiboles. The metals contained in pyrite, magnetite, chalcopyrite, sphalerite, galena and traces of pyrrotite and arsenopyrite. The paragenetic sequence shows also in the Oridda region a first phase of higher temperature skarns with only small metallic deposition a second phase, with hydrothermal characteristics, to which the main ore depostion is related.

3) South Eastern Sulcis
(Teuladese and minor occurrences)

The more important mineralization related to skarn in this region are contained in the carbonate intercalations (Alternanze) of the Nebida Fm, metamorphosed extensively by intruding granites. These are two types of skarnized and mineralized carbonate bodies: the stratigraphically lower ones (Filone Morettu and Sideru Boi), beloging to the Matoppa Mbr, and the upper ones. in the P.ta Manna Mbr, shortly below the stratigraphic contact with the Gonnesa Fm. Considering the different lithologies of the carbonates, it seems quite clear that higher concentrations of metamorphic and metallic minerals are related to limestones with flaser texture. The metamorphic paragenesis is quite similar to the more northrn areas: Ca-garnet, epidote, tremolite, sericite, chlorite, quartz, fluorite, calcite. The ore minerals are variable in grade and ratio, but the most abundant are: pyrite, sphalerite, galena, magnetite, pyrrotite, marcasite, chalcopyrite. There are traces of sulphosalts, mackinavite, bornite and haematite. Generally in the Alternanze we could speak more about calcic hornfels than skarns, with certain exceptions as Sideru Boi. The latter can be classified as metamorphic skarns.

In conclusion, in the investigated areas are present and mineralized only the exoskarns, with the prevalence of metamorphic skarns (along stratigraphic contacts) on vein skarns and hornfels. The temperatures of the sharns range from 600°C (wollastonite eql.T) to about 400°C (hydrothermal phase with depostion of epidote and chloritization).

The bulk of the ore minerals is related to the hydrothermal phase, through a remobilization of metals contained in the Lower Paleozoic stratabound deposits, with a minor contribution of granofile elements from the intruding magmatic bodies.

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AURISICCHIO C.*, FIORAVANTI C.**, GRUBESSI O.**, ZANAZZI P.F.*** - *Reappraisal of crystal-chemistry of beryl*

The complex crystal-chemistry of beryl has been revisited on the basis of new chemical analyses and X-ray structural refinements on samples with different origins and different compositions.

The results show that the main substitutions concern Al in the octahedral sites, and Be in the tetrahedral sites, by divalent and Li ions respectively: both the substitutions are balanced by the entry of Na^+, K^+, Rb^+, Cs^+ cations into the 2a position whithin the channels (namely between the six-membered Si rings), whereas the 2b position (at the center of the ring) is preferentially occupied by water molecules. The extent of the Al and Be substitution is limited by the electrostatic unbalance arising from the bond strenght deficiency on 0 (2).

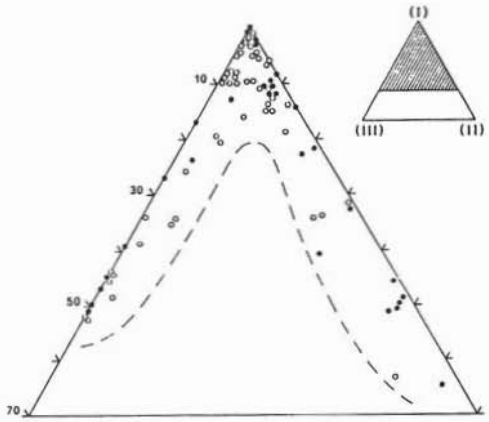

Fig. 1

The effect of these substitutions on the lattice parameters (particularly on the c/a ratio) allows the definition of different families of beryls: the «octahedral» beryls, i.e. beryls where $Al\text{-}Me^{2+}$ represents the main isomorphous replacement, are characterized by c/a values in the range 0.991-0.996; the «tetrahedral» beryls, where Be-Li is the main substitution, with c/a values in the range 0.999-1.003; the «normal» beryls, with c/a ratios between 0.997-0.998, including the beryls where the two substitutions occur together, though to a limited extent. A gap of miscibility exists between «octahedral» and «tetrahedral» beryls, as shown in Fig. 1, where several analyses of beryls are plotted in a ternary diagram with the three end-members I, II and III (normal, tetrahedral an octahedral beryls, respectively).

The formation of beryls belonging to either series has been ascribed to the chemical constraints of the environment, as the bulk rock chemistry and the fluid phase composition, and to the physical-chemical conditions during the mineral growth.

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BARBAGELATA S.*, MESSIGA B.**, PICCARDO G.B.*, VANNUCCI R.** - *Proterozoic post-orogenic plutonism in SE Greenland: trace element evidence for mantle-crust interaction*

In the Angmagassalik District (Se-Greenland) post-tectonic plutons represent the last event in Nagssugtoquidian belt and follow the second major phase of deformation 1900 M.y.old.

The investigated intrusive complex is mainly represented by a stratigraphic lowermost mafic-ultramafic rock sequence (peridotites, norites, gabbro-norites) and an uppermost intermediate-acidic sequence