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Radioactive albitites bordering the Ilímaussaq complex: Agpat and Søndre Siorarssuit

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In 1957, during the early uranium prospecting history in the Ilímaussaq intrusive complex, rich radioactive mineralisation was discovered at Agpat, on the south coast of Tunugdliarfik (Sørensen, 1957). The following year a number of radioactive samples were analysed at Risø and they proved to be mainly rich in thorium. A few of them, however, contained uranium in the order of 1000 ppm. In 1962 a 200 m deep hole was drilled in black lujavrite at the plateau 300 metres above sea level close to Agpat. The hole did not intersect radioactive mineralisation comparable to what was found at the coast, and the Agpat mineralisation attracted no further attention. During 1978 a field excursion for uranium geologists visited Agpat as an example of radioactive mineralisation at the border zone of the alkaline complex. The importance of the mineralisation was emphasised as it represents an epigenetic radioactive enrichment different from the refractory steenstrupine mineralisation in lujavrites. Transport of radioactive elements along the border of the complex may also result in mineralisation in the surrounding supracrustal rocks, and the observations made at Agpat point to the sandstone and lava series of the Eriksfjord Formation as an important exploration target.

Radioactive albitites at the northern contact of the Ilímaussaq intrusion (Rose-Hansen *et al.*, 1977) are poor in thorium compared with uranium. They may have a high content of niobium. During field work in 1979 the author discovered radioactive albitites at Sdr. Siorarssuit in the quartzites bordering the south-western contact of the intrusion. A preliminary account of the radioactive albitites at Agpat and Sdr. Siorarssuit is presented below.

Agpat

The geology around Agpat has been briefly described by Ussing (1912) and Ferguson (1970). The contact relations between the Ilímaussaq intrusive rocks and the country rocks are controlled by a complicated fault system which strikes NNW and forms the western contact of a down-faulted quartzite block of the Eriksfjord Formation. To the south and east the quartzite block is bordered by Julianehåb granite, which crops out exactly at sea level below the quartzite. The NNW fault and the quartzite are intersected by a major fault along Lakseelv.

Crossing the NNW fault system from west to east along the coast the general succession of rocks is: (1) lujavrite, (2) various breccia rocks, (3) kakortokite-like rocks, (4) Julianehåb granite. This suite can be best studied in a 15 m high and 50 m wide cave and in the coastal cliff at the small beach immediately to the east of the cave.

Lujavrite

The lujavrite is of a coarse grained, often banded type. It will not be described further in this context.

Breccia rocks

At least two generations of brecciation can be distinguished. Quartzite blocks and layered fragments of albitite with iron sulphides are embedded in a dense, grey albitite matrix. The inclusions are partly rounded, ranging in size from a few millimetres to several metres. Both generations of albitite are accompanied by intense fluorite mineralisation. Randomly orientated needles of aegirine and arfvedsonite occur in the albitites along their margins, and spots or 'stars' of aegirine/arfvedsonite may also be found, usually with sharp boundaries to pure albitite. Characteristically, the 'pure' albitites consist of 80–90 per cent (vol) albite. The remaining volume, which is mainly an intergranular matrix, contains varying amounts of fluorite, calcite, rutile and radioactive minerals. Besides being finely distributed in the albitite, dark violet fluorite can be seen as massive fillings between the inclusions.

The albitite is found in more continuous masses in the eastern part of the cave and in the coastal cliff at the beach. This albitite is strongly distorted and it is within these units that the richest radioactive mineralisation is found, most often in dark irregular layers (fig. 1). Nodules, 1–2 cm in diameter, rich in iron sulphides, are locally seen in the albitite in the cave.

The intrusive character of the albitite is emphasised by its sharp contacts to the surrounding rocks of which quartzite and kakortokite-like rock have been found as angular blocks in the breccia. The quartzite contains a few per cent plagioclase, fluorite and a brownish mica mineral embedded in a recrystallised quartz matrix. A block of dark porphyritic lava in the western part of the cave is believed to be a large xenolith in the breccia. The lava is strongly sheared and altered to chlorite and sericite. Joint planes commonly contain fluorite coatings.

The radioactivity is mainly due to scattered euhedral crystals of thorite and uranothorite.

Fig. 1. Dark radioactive layer in albitite.

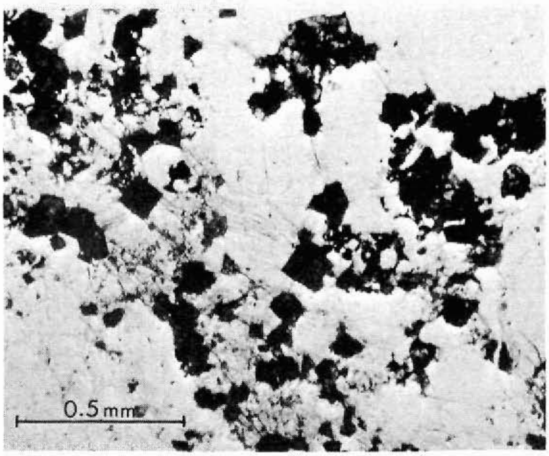

Fig. 2. Uranothorite in albitite.

The crystals, which are centres for a characteristic network of cracks, are strongly metamict (fig. 2).

Fission track studies and microscopy on polished sections have shown that the albitite is also rich in a radioactive carbonaceous thucolite-like material, occurring as irregular cavity fillings. The carbonaceous material consists of at least two phases of different chemical composition as well as different amounts of graphite (fig. 3). Qualitative microprobe studies show that the phase of highest reflectance has additionally sulphur, uranium and thorium as major elements whereas the darker inclusions contain mainly silicon, sulphur and thorium.

Appreciable amounts of niobium occur in the rutile.

A limited number of chemical analyses were carried out on radioactive samples from the albitite. The uranium content varies from a few hundred ppm to more than 5000 ppm. Thorium amounts to several per cent of the samples. Table 1 summarises some analytical results obtained by delayed neutron counting (U), gamma spectrometry (U, Th) and energy dispersive X-ray fluorescence analysis (Nb, Zr, Y).

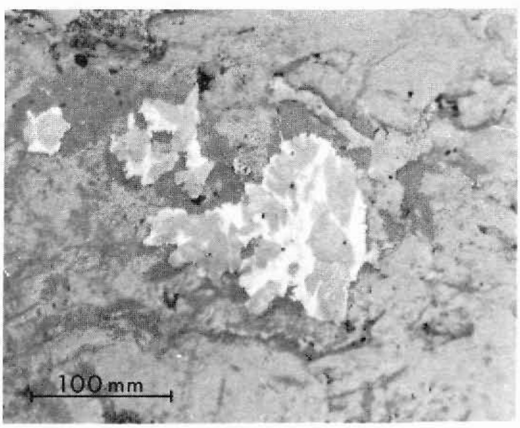

Fig. 3. Cavity filling of carbonaceous matter consisting of two phases.

Table 1. Chemical analyses of radioactive albitite from Agpat

GGU no.	U(ppm)	Th(ppm)	Nb(ppm)	Zr(ppm)	Y(ppm)
223956	332	7800	420	250	340
223957	76	3400	30	80	50
223961	3390	33000	770	1330	780
223963	5200	46000	2480	1700	1110
223968	1210	15000	1020	460	470
223969	1200	18000	980	530	560

Kákortokite

The kakortokite-like rock was described by Ussing (1912) as a sodalite-bearing kakortokite without layering or lamination. The pegmatitic veins in the rock are strongly irregular. The contact between albitite and kakortokite-like rock is usually steep and sharp. A block of the kakortokite-like rock very rich in aegirine is found in the albitite breccia in the eastern part of the cave.

Hematite is frequently found in the rock.

Julianehåb granite

The granite exposed in the coast at outcrops to the east of the beach is cut by pegmatites and veins originating from the Ilímaussaq complex. It shows no anomalous radioactivity. Further to the east the Julianehåb granite, as well as the overlying quartzite, is cut by radioactive hydrothermal veins. The veins are of two types (a) aegirine-albite veins and (b) quartz-aegirine veins. The veins may correspond partly to radioactive veins described by Hansen (1968) from the north coast of Tunugdliarfik. Their possible relation to the albitite is at present not clearly understood.

Søndre Siorarssuit

A dyke-like intrusion of albitite is found along the coast of Tunugdliarfik at Sdr. Siorarssuit outside the western border of the Ilímaussaq complex. The 'dyke' is steep and can be followed along a linear structure for about 1 km. It has a width varying between 0.5 and 5 m. The regional orientation is NE but the strike is locally very irregular. The country rocks consist of quartzite and, in the westernmost extension of the dyke, the underlying Julianehåb granite. In the granite the albitite forms a pipe-like structure and contains xenoliths of quartzite which have presumably subsided into the pipe.

Local, irregular layering structures in the albitite are explained as bedding planes in settling ash particles caused by pressure release during the intrusion.

Albitite veins have been mentioned by Hansen (1969) north of Tunugdliarfik. These veins are, however, only a few millimetres in thickness.

The albitite in the quartzite contains subordinate quartz near the contacts, and the bordering quartzite may contain cavities with secondary quartz fillings and a small amount of aegirine needles. Fluorite and synchysite (Ole V. Petersen, personal communication) have been observed in the albitite at a few localities.

The radioactivity of the albitite at Sdr. Siorarssuit varies from 2 to 10 times the activity of quartzite. No analyses have yet been carried out to determine the proportions of thorium and uranium.

Conclusions

It is believed that the albitite generations at Agpat and Sdr. Siorarssuit were emplaced as a 'powder' during explosive intrusive events. This tuffaceous breccia later underwent recrystallisation and possibly also metasomatism. The emplacement of the albitites has probably been preceeded by a regional tectonic disturbance with local faulting and brecciation. This disturbance accounts for the down-faulting of the quartzite block at Agpat and presumably controls the intrusion of the dyke-like linear albitites at Sdr. Siorarssuit along a regional zone of weakness with NE strike.

The relations between the Ilímaussaq complex and the late albitites at Agpat and Sdr. Siorarssuit remain to be investigated in detail. The immediate future work will include more mineralogical and chemical investigations; the field sites must be mapped and described in detail and the contact zone elsewhere between the Ilímaussaq intrusive rocks and the bordering supracrustals should be further explored for similar mineralisation, which is believed to have an areal extension greater than presently known.

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