AN AMAZONITE APLITE DIKE FROM LABRADOR

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Introduction

While carrying on geological reconnaissance work in Labrador a small dike of unusual chemical and mineralogical composition was encountered by the writer at Long Tickle. Its exact location is difficult to determine, due to the poor charting of that section of coast. Judging by a sketch plan of the Adlavik region[1] found at the Newfoundland Crown Lands Office in St. John's some time after the region was visited, it lies in latitude 55°3′N. and longitude 58°46′W. on the south shore of the northern Adlavik Island, about a mile east of Maconet Bay.

Field Characters

The dike is five feet wide and strikes in a northerly direction, with steep easterly dip. No variation in size or attitude was observed, but the exposed portion of the dike was not over several hundred yards long.

The wall rock is a coarse grained, light pink to gray syenite, showing foliated zones. For a foot or so on each side of the dike the mafic constituents of the wall rock have been changed into red-brown mica.

The margins of the dike are sharply defined. Judging by the curvature of foliation in the wall rock near the dike, and the displacement of a narrow foliated zone which the dike cuts, it has been injected into a fault plane along which the west wall has been displaced several feet northward.

The dike rock is fine grained and of a very pale greenish color. It contains some 10% of amazonite phenocrysts and a little brownish mica in small flakes. It is foliated about parallel to the walls. Close examination seems to show a linear arrangement of the constituents dipping about 60° in a northerly direction, and directed slightly towards the west wall of the dike, instead of being exactly parallel to it.

[1] *Sketch Plan of Adlavik Region,* rivers surveyed by Mr. W. J. James, and sketch of coast and islands by W. T. Grenfell ex Yacht "Jeanette," August 1916.

Microscopic Characters

Under the microscope the rock is seen to be made up of amazonite, albite, and quartz, with accessory mica, topaz, fluorite, apatite, magnetic yellow sulfide, and perhaps rutile or zircon. Table I shows the proportions of these minerals as determined by measurement of grains in portions of the rock powder separated with heavy liquids, the sulfide being isolated from the heavy portion by a permanent magnet.

The amazonite in part has the optical properties of microcline. However, in some grains the optic axial angle is undoubtedly positive. This would indicate that the amazonite is in part isomicrocline. In the isomicrocline 2V appears to vary from a minimum of 75° perhaps to 90°. Efforts to correlate the optical and crystallographic orientation in this mineral were not satisfactory, but it seems to differ from normal microcline only by a shifting of the primary optic axes towards c. The refractive indices of the two minerals are very similar. There does not seem to be any great predominance of either mineral in the thin section, but the two could not be separated on a quantitative basis.

In thin section the amazonite is so abundant that without the analyzer the rock shows a nearly continuous matrix of this mineral with rounded grains of quartz and albite, and flakes of mica inset in it. With the analyzer it is seen to be made up of rounded, interlocking grains averaging 0.5 mm. in diameter with various orientations. Occasional irregular grains 4 mm. long are embedded in the matrix of smaller grains. Most of the grains show a well developed grating structure but twinning may be entirely absent. Polysomatic textures occur.

The albite has indices of refraction less than balsam, indicating practically complete absence of anorthite molecules. Twinning is not uncommon. It occurs as irregular, rounded grains up to 0.8 mm. long, some with a tendency towards blocky crystal outlines. It may cut into flakes of mica and grains of amazonite rather deeply. A small amount of the mineral also occurs as spindles of microperthite 0.005 mm. wide in the amazonite. They appear to lie parallel to the crystallographic *c* axis and make up only an insignificant proportion of the areas of amazonite.

The quartz also occurs in small rounded grains, occasionally with slight development of crystal outlines. It may cut into the feldspars and mica. Some grains show anomalous biaxial character

to a slight degree, and strain shadows when rotated under crossed nicols.

The optical properties of the mica are in accordance with those given by O. Mügge for zinnwaldite.[2] It occurs as flakes up to 1.15 mm. long. They are often of irregular outline, being cut into by the other minerals of the rock, and occasionally sending small projections into them.

In the topaz 2V is 65°, β is close to 1.615 and the birefringence is about 0.01. It occurs as irregular grains up to 0.2 mm. in diameter which join in the saccharoidal texture of the rock.

Apatite and fluorite are both automorphic. The former is in prisms up to 0.1 mm. long with rounded edges, while the latter is in minute fragmental grains. The yellow sulfide is almost absent from the section. Minute quadratic prisms with very high refractive indices and birefringence, and parallel extinction, that are believed to be zircon or rutile occur very rarely.

Alteration is very slight, though there is a little clouding in the section, especially in the amazonite. It consists of a few small nests of a pale green flaky mineral with moderate refractive indices and birefringence. These occur in the feldspars.

With the exception of the amazonite phenocrysts and the tendency towards automorphism in quartz and albite the texture of the rock is, on the whole, saccharoidal. The phenocrysts are by no means well formed, their margins being intergrown with quartz and albite grains, and included grains of these minerals are not uncommon far from their margins. Thus, their growth was certainly not completed, and probably not even started much before that of the other constituents. Furthermore, the automorphism of quartz and albite is not at all pronounced and it seems probable that only a small proportion of these minerals completed their growth before the other minerals of the groundmass, the period of crystallization of the quartz ending slightly earlier than that of the albite.

Strain shadows and anomalous biaxial character in quartz, and polysomatic texture in amazonite point towards differential movement within the dike, as does also the foliated structure of the rock. The movement must have occurred during the period of crystallization since there is no evidence of shearing. Whether it

[2] Rosenbusch's *Mikroskopische Physiographie*, vol. 1, part 2, p. 584, No. 7, 1927.

resulted from magmatic flow, or from movement of the walls of the fault in which the dike was intruded, could not be determined.

Mineralogical Classification

On the basis of mineral composition the rock might be classed as either pegmatite or aplite. The fine grain and prevalence of allotriomorphic texture are characteristic of aplite. Though granophyric texture is absent, volatile constituents were present in greater amounts than in typical aplites, as shown by the alteration of the mafic constituents of the syenite, adjacent to the dike, to brown mica. The resulting fluidity of the magma probably accounts for the porphyritic development and slight automorphism. On the whole it seems best to consider the rock intermediate between aplite and pegmatite, and more nearly approaching the former in character.

Chemical Character

The chemical analysis of the rock is given in Table I. It is remarkable for the high soda-potash ratio and the extremely low content of calcium, magnesium, and iron.

Table I

Composition of Amazonite Aplite, Specimen 2–225

(Analyzed by Mary G. Keyes)

Chemical	Analysis	Norm		Mode	
SiO_2	73.25	Or	23.35	Amazonite	48.0
Al_2O_3	15.23	Ab	53.97	Albite	28.5
Fe_2O_3	0.06	An	0.28	Quartz	19.0
FeO	0.52	Q	20.46	Zinnwaldite	3.0
MgO	0.06	C	0.41	Topaz	1.0
CaO	0.03	Total	98.47	Pyrrhotite?	0.1
Na_2O	6.35			Fluorite, Apatite, Zircon?	0.4
K_2O	3.95	Hy	1.02		
H_2O+	0.16	Total	99.49		
H_2O-	0.12			Total	100.00
TiO_2	none				
P_2O_5	0.03				
MnO	0.02				
Li_2O	p.n.d.				
Total	99.78				

Sp. G. 2.642 ± .002

C.I.P.W. Classification: 1.4.1.4.

Spectrographic examination shows an appreciable amount of lithium, which is concentrated in the mica. Also this mineral appears to contain more iron than magnesium, and shows traces of rubidium.[3] These chemical characteristics of the mica are in agreement with the optical properties.

A comparison of the norm and mode of the rock, given in Table I shows a marked discrepancy between the amount of modal amazonite and Or. This is corrected if the excess of Ab over modal albite is added to the Or to make up the modal amazonite, indicating that the amazonite contains 54% of albite molecules.This suggests that the positive optical character of the mineral may be connected with a high content of albite molecules.

The very low An of the mode corresponds with the low indices of refraction of the albite in the thin section.

Though the alkali content of the rock, especially the soda, is unusually high, it can not be classed as a typically alkaline rock, since none of the accessory minerals characteristic of that series occur in it. Also the excess of soda is accompanied by an excess of silica, rather than a deficiency.

The chemical character of the rock is so unusual that none of the analyses given by Washington[4] agree closely with it. This is probably the result of a high degree of differentiation from the parent magma. The rocks which resemble it most closely in chemical composition are all extrusive or hypabyssal. Those for which the modes were examined generally showed minerals typical of the alkaline series, the closest being a commendite.[5]

Relation to Other Rocks on the Coast

The syenite in which the amazonite aplite occurs is cut by numerous small dikes which resemble the wall rock more or less closely in mineral composition. They are finer grained, and generally contain quartz in addition to the minerals shown by the syenite. They probably represent later differentiates of the magma from which the syenite crystallized, and the amazonite aplite may well be an extreme member of this series.

The syenite shows affinities with the alkaline series. It contains

[3] Personal communication from Prof. J. Papish, Cornell University.

[4] Washington, H. S. Chemical Analysis of Igneous Rocks: *U.S. Geol. Survey, Professional Paper,* No. 99, 1917.

[5] *Op. Cit.*, p. 160, No. 75.

roughly 35% of albite. The mafic minerals consist of a little biotite and hornblende, but the latter has a negative optic axial angle of about 35°. Thus it may contain a high percentage of riebeckite molecules.[6] The low index feldspar has the optical properties of isorthoclase, which may indicate, by analogy with the suggestion for isomicrocline, that it also has a high soda content.

The dike from which the specimen here described was taken was the only one of the kind encountered by the writer in his cursory examination of the island. However, Daly mentions a dike which appears to be somewhat similar, cutting granitite some 25 miles E. by S. of this locality on the mainland opposite Jigger Island.[7] This suggests that the series of which the aplite is a member may be fairly extensive.

[6] Winchell, A. N. Further Studies in the Amphibole Group: *Amer. Mineral.*, vol. **XVI,** p. 262, 1931.

[7] Daly, R. A. The Geology of the Northeast Coast of Labrador: *Bulletin of the Harvard Museum of Comparative Zoology*, vol. **XXXVIII,** pp. 213–214, 1902.