

PETROGRAPHY OF SOME ERRATICS FROM CAPE ROYDS, ROSS ISLAND, ANTARCTICA

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ABSTRACT

A petrographical study is made of a suite of rocks collected by the British Antarctic Expedition, 1907-9, from Cape Royds, Ross Island, Antarctica. Of the 169 thin sections examined, 163 are of erratics. The igneous specimens constitute approximately 80 per cent of the collection, and may be described as typical East Antarctica rocks.

INTRODUCTION

Cape Royds, located in about latitude 77°33' S and longitude 166°07' E, is a promontory on the west side of Mount Erebus, Ross Island, Antarctica.

Results of other studies of Cape Royds erratics have been published. Benson's (1916) contribution relates to the dolerites collected chiefly from the moraines. Jensen (1916) records descriptions of anorthoclase trachyte, phonolitic trachytes, biotite-hornblende trachyte, acid and basic types of kenytes, shonkinitic kenyte porphyry, and porphyritic feldspar-olivine basalt. Smith (1954) refers briefly to the erratics of the Cape Royds district. Thomson (1916) in his microscopical studies of inclusions of the volcanic rocks of the Ross Archipelago mentions the occurrence of certain erratics, including a basic type of alkaline trachyte or orthophyre, sanidinite, and biotite microsanidinite. Walkom (1916), in discussing the petrography of pyroxene granulites, groups these rocks into acid, scapolite-bearing, and basic. Woolnough (1916) describes pegmatites, aplite, sodalite syenites, quartz diorite, granophyric granite porphyry, granophyre, feldspar porphyry, minettes, vogesite, porphyrite, sericitized diabase porphyry, sölvbergites, sapphire-bearing trachyte, corundum-bearing trachyte, spherulitic trachyte, dense porphyritic basalt, actinolite gneiss, tremolite gneiss, actinolite schists, fine tremolite schist, spotted schist, phyllite, quartz schist, and micaceous sandstone.

CLASSIFICATION OF THE ROCKS

The specimens, represented by 169 thin sections, were collected by Sir Raymond E. Priestley, Geologist, British Antarctic Expedition, 1907-9. Aside from rocks 295A thru 295F and B-A thru B-R, whose numbers were either illegible or missing, the original numbering system is retained. Only six sections, 295, 295A-D and F, all kenytes, are of rocks collected *in situ*.

The collection contains 72 plutonites ranging in composition from

leuco-sodaclase adamellite to gabbro, leucoadamellites, adamellites and granodiorites predominating. There are 13 sections of hypabyssal rocks. Of the 54 extrusives, 29 are of basaltic compositions. Sedimentary rocks are represented by one breccia. Of the 28 rocks classified as metamorphic, 20 are gneisses, and of these 12 are granodioritic. One specimen of vein quartz is represented.

The rocks of this suite are: Pegmatite (211), leuco-sodaclase adamellite (195, 273), leucogranite (204, 242, 256, 300, 309, 324), garnetiferous leucogranite (308), leucogranodiorite (189, 244, 258, 287, 307), porphyritic leucogranodiorite (236), leucotonalite (B-K), leucoadamellite (196, 202, 207, 221, 230, 235, 237, 245, 260, 268, 299, 328), garnetiferous leucoadamellite (213), sodaclase granite (192), quartz granodiorite (251), adamellite (176, 180, 210, 223, 226, 227, 241, 246, 275, 304), porphyritic adamellite (272, 326, B-F), granodiorite (198, 208, 222, 229, 250, 257, 259, 269, 270, 293, 302, 305, 327, B-G), porphyritic granodiorite (191, 282), tonalite (173, 228, B-N, B-Q), diorite (281), syenogabbro (190), gabbro (200, 225, 240, 262) and melagabbro (279); graphic granite porphyry (261), leuco-sodaclase adamellite porphyry (298), micrographic granite porphyry (271), granophyric adamellite porphyry (186), granophyric granodiorite porphyry (B-I), granodiorite porphyry (234), diabase (206, 219, 332), kersantite porphyry (303) and camptonite (205, 252); granophyre (9, 11), biotite granophyre (B-L), granophyre porphyry (199), spherulitic granophyre porphyry (314, 323), altered vesicular extrusive (233), rhyolite porphyry (247), trachyte (226, 277), kenyte (212), kenyte, acid variety (238, 295, 295A-F), vitrophyric kenyte (183, 194, 243, B-B, B-O), plagioclase kenyte (286), basalt (174, 188, 217, 220, 239, 278, 329, 331), vesicular basalt porphyry (185, 224), olivine basalt (232, 254, B-P), olivine basalt porphyry (1, 184, 249, 274, B-C, B-J), vesicular olivine basalt porphyry (B-A), enstatite basalt (264), orthopyroxene basalt (283), vesicular analcime basalt (218), analcime basalt porphyry (182, 201, 263), basalt tuff (289) and amygdaloid (265); breccia (B-H); biotite-actinolite gneiss (187), leucogranodiorite gneiss (193, 316, 321, B-D), granodiorite gneiss (171, 172, 203, 214, 216, 248, 253, 280, 292, 294, 296, B-M), tonalite gneiss (215, 297) and diorite gneiss (197); biotite-quartz schist (179) and calcareous biotite-quartz schist (231, 284); quartzite (12, 175, 317, B-E); ferruginous slate (B-R); vein quartz (177).

The improved Wentworth recording micrometer was used in the quantitative determination of the constituents of 66 sections of igneous rocks (Table 1). An aggregate distance of 56,600 units was measured in traversing each section 16 times. These rocks have been named and classified in accordance with the system of Johannsen.

CHARACTERISTICS OF THE ROCKS

Zoned plagioclases are not frequently observed in rocks of East Antarctica, whereas they are commonly noted in acid and intermediate intrusives of West Antarctica. In the Cape Royds suite eight acid and intermediate igneous rocks exhibit distinct zoning of the plagioclases. Indistinct zoning of the plagioclases is observed in over 30% of all erratics examined. Over 50% of the erratics contain micropertthite, which characterizes "Atlantic-type" rocks. Myrmekitic intergrowths are

TABLE 1. MINERALOGICAL COMPOSITION OF SOME ERRATICS FROM CAPE ROYDS, ROSS ISLAND, ANTARCTICA

Minerals	Specimens												
	251	307	210	195	223	308	244	192	202	230	304	272	207
Quartz	46.89	44.11	39.32	37.88	36.74	36.73	35.73	34.73	33.21	32.73	32.68	32.48	32.30
K-feldspar	12.04	9.56	26.56	25.27	23.67	43.14	15.13	37.39	30.89	37.90	35.46	24.75	38.41
Albite	—	—	—	34.06	—	—	—	21.44	—	—	—	—	—
Oligoclase	29.68	43.17	25.71	—	33.65	17.00	44.93	—	33.66	27.30	25.33	34.72	27.25
Labradorite	3.32	—	—	—	—	—	—	0.32	—	—	0.46	—	—
Hornblende	{ 8.07	{ 3.16	{ 8.09	{ 1.75	{ 5.63	{ 0.97	{ 3.97	{ 5.86	{ 2.06	{ 1.89	{ 6.07	{ 8.05	{ 1.91
Chlorite	—	—	—	—	—	—	—	—	—	—	—	—	—
Biotite	—	—	—	—	—	—	—	—	—	—	—	—	—
Augite	p	p	—	1.05	p	p	p	p	p	p	p	p	p
Muscovite	p	p	p	—	p	p	p	p	p	p	p	p	p
Apatite	p	p	p	—	p	p	p	p	p	p	p	p	p
Zircon	p	p	p	—	p	p	p	p	p	p	p	p	p
Fluorite	—	—	—	—	p	—	—	—	—	—	—	—	—
Garnet	—	—	—	—	—	2.17	—	—	—	—	—	—	—
Sphene	p	p	p	—	—	p	p	p	p	p	p	p	p
Pistacite	p	p	—	—	—	—	p	p	—	—	—	—	p
Zoisite	p	—	—	—	—	—	—	—	—	—	—	—	p
Allanite	p	—	—	—	p	—	p	p	p	p	p	p	p
Schorlrite	—	—	—	—	p	—	—	p	p	p	p	p	p
Pyrite	p	p	p	—	—	—	—	—	—	—	—	—	—
Magnetite	p	p	p	p	p	p	p	p	{ 0.18	{ 0.17	p	p	p
Hematite	p	p	p	p	p	p	p	p	p	p	p	p	p
Leucoxene	—	—	—	p	—	—	—	—	p	—	—	—	—
Calcite	—	—	p	—	—	p	—	—	—	—	—	p	—
Kaolin	p	p	p	p	p	p	p	p	p	p	p	p	p
Sericite	p	p	p	p	p	p	p	p	p	p	p	p	p
Accessories	p	p	0.32	p	0.32	p	0.25	0.26	p	p	p	p	0.14
	100.00	100.00	100.00	100.01	100.01	100.01	100.01	100.00	100.00	99.99	100.00	100.00	100.01

p = present

251. Quartz granodiorite
307. Leucogranite
210. Adamellite
195. Leuco-sodaclase adamellite

223. Adamellite
308. Garnetiferous leucogranite
244. Leucogranodiorite
192. Sodaclase granite

202. Leucoadamellite
230. Leucoadamellite
304. Leucoadamellite
272. Porphyritic adamellite
207. Leucoadamellite

TABLE 1 (Continued)

Minerals	Specimens												
	287	293	B-K	237	242	324	245	221	180	236	298	226	189
Quartz.....	31.97	31.91	31.88	31.88	31.83	31.44	31.41	31.40	31.28	30.80	30.76	30.36	30.14
K-feldspar.....	21.62	13.20	1.81	38.32	33.33	41.30	31.83	36.72	31.69	18.16	31.04	30.57	9.96
Albite.....	45.49	43.57	61.76	22.45	31.61	26.72	34.32	31.09	30.09	46.01	34.13	33.79	54.86
Oligoclase.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Labradorite.....	—	4.00	—	—	—	—	—	—	—	p	—	—	—
Hornblende.....	{ 0.65	{ 6.66	{ 4.54	{ 1.15	{ 2.51	{ 0.63	{ 2.22	{ 0.78	{ 6.58	{ 5.03	{ 4.06	{ 5.28	{ 4.88
Chlorite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Biotite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Augite.....	p	p	—	5.92	—	p	—	p	p	—	p	—	—
Muscovite.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Apatite.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Zircon.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Fluorite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Garnet.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Sphene.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Pistacite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Zoisite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Allanite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Schorlite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Pyrite.....	—	—	—	{ 0.27	{ 0.61	—	—	p	{ 0.15	p	—	p	p
Magnetite.....	p	p	p	—	p	p	p	p	—	p	p	p	p
Hematite.....	p	p	—	—	p	p	p	p	—	p	p	p	p
Leucoxene.....	—	—	—	—	—	—	—	—	—	p	p	p	—
Calcite.....	—	—	—	—	—	p	—	—	—	p	p	p	—
Kaolin.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Sericite.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Accessories.....	0.26	0.65	p	p	0.13	p	0.21	p	0.21	p	p	p	0.16
	99.99	99.99	99.99	99.99	100.02	99.99	99.99	99.99	100.00	100.00	99.99	100.00	100.00

p = present

287. Leucogranodiorite
 293. Granodiorite
 B-K. Leucotonalite
 237. Leucoadamellite

242. Leucogranite
 324. Leucogranite
 245. Leucoadamellite
 221. Leucoadamellite

180. Adamellite
 236. Porphyritic leucogranodiorite
 298. Leuco-sodaclase adamellite porphyry
 226. Adamellite
 189. Leucogranodiorite

TABLE 1 (Continued)

Minerals	Specimens												
	208	269	260	196	328	222	213	235	270	228	176	259	229
Quartz.....	29.86	29.53	29.40	29.01	29.01	28.61	28.57	28.31	28.27	28.25	27.64	27.51	27.13
K-feldspar.....	17.58	14.05	26.38	35.42	34.64	15.81	29.69	26.16	26.66	1.92	31.41	11.61	22.55
Albite.....	44.81	50.62	39.70	32.13	33.85	48.21	40.83	41.60	39.67	59.54	34.48	54.70	43.98
Oligoclase.....	0.66	—	—	—	—	—	—	—	—	—	—	—	—
Labradorite.....	7.00	5.55	4.53	2.98	2.49	7.37	0.30	3.92	5.40	9.24	6.37	6.18	6.17
Chlorite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Biotite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Muscovite.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Apatite.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Zircon.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Fluorite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Garnet.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Sphene.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Pistachite.....	p	p	—	p	—	—	—	—	—	p	—	—	p
Zoisite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Allanite.....	p	—	p	p	p	—	—	p	p	p	p	—	p
Schorlite.....	—	p	—	—	p	—	—	—	—	—	—	—	—
Pyrite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Magnetite.....	p	p	p	0.32	p	p	p	p	p	0.27	p	p	p
Hematite.....	p	p	p	p	p	p	p	p	p	—	p	p	p
Leucoxene.....	—	p	—	—	p	—	—	—	—	—	—	—	p
Calcite.....	p	p	p	p	p	p	p	p	p	—	—	—	p
Kaolin.....	p	p	p	p	p	p	p	p	p	—	p	p	p
Sericite.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Accessories.....	0.11	0.25	p	0.14	p	p	0.60	p	p	0.77	0.12	p	0.16
	100.02	100.00	100.01	100.00	99.99	100.00	99.99	99.99	100.00	99.99	100.02	100.00	99.99

p = present

208. Granodiorite
 269. Granodiorite
 260. Leucoadamellite
 196. Leucoadamellite

328. Leucoadamellite
 222. Granodiorite
 213. Garnetiferous leucoadamellite
 235. Leucoadamellite

270. Granodiorite
 228. Tonalite
 176. Adamellite
 259. Granodiorite
 229. Granodiorite

TABLE 1 (Continued)

Minerals	Specimens												
	299	327	256	258	B-G	273	B-F	326	186	275	282	227	268
Quartz.....	26.81	26.78	26.77	26.76	26.49	26.23	26.07	25.19	23.73	23.73	23.72	22.46	22.00
K-feldspar.....	40.81	20.91	27.22	22.07	34.52	37.75	31.13	35.03	29.88	28.50	9.92	42.07	47.10
Albite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Oligoclase.....	27.46	46.50	43.68	49.50	33.43	32.17	36.16	34.52	39.10	37.88	52.16	29.20	29.07
Labradorite.....	p	—	—	—	—	—	—	p	—	—	4.39	—	—
Hornblende.....	{ 4.44	{ 5.81	{ 2.34	{ 1.65	{ 5.56	{ 3.85	{ 1.76	{ 4.69	{ 7.18	{ 9.50	{ 9.25	{ 6.27	{ 1.83
Chlorite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Biotite.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Augite.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Muscovite.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Apatite.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Zircon.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Fluorite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Garnet.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Sphene.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Pistacite.....	p	—	—	—	—	—	—	—	—	—	—	—	—
Zoisite.....	p	—	—	—	—	—	—	—	—	—	—	—	—
Allanite.....	p	—	p	—	p	p	p	p	p	p	p	p	p
Schorlite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Pyrite.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Magnetite.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Hematite.....	p	—	—	—	—	—	—	—	—	—	—	—	—
Leucocoxene.....	—	—	—	—	—	—	—	—	—	—	—	—	—
Calcite.....	—	—	—	p	p	p	p	p	p	p	p	p	p
Kaolin.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Sericite.....	p	p	p	p	p	p	p	p	p	p	p	p	p
Accessories.....	0.48	p	p	p	p	p	0.78	0.57	0.11	0.40	0.56	p	p
	100.00	100.00	100.01	99.98	100.00	100.00	100.00	100.00	100.00	100.01	100.00	100.00	100.00

p= present

299. Leucoadamellite
 327. Granodiorite
 256. Leucogranodiorite
 258. Leucogranodiorite

B-G. Adamellite
 273. Leuco-sodaclase adamellite
 B-F. Porphyritic adamellite
 326. Porphyritic adamellite

186. Granophytic adamellite porphyry
 275. Adamellite
 282. Porphyritic granodiorite
 227. Adamellite
 268. Leucoadamellite

TABLE 1 (Continued)

Minerals	Specimens													
	309	198	191	246	300	302	250	241	B-N	305	257	279	173	190
Quartz.....	21.67	21.41	20.18	18.97	18.46	16.65	13.31	14.82	12.83	11.23	7.55	6.68	3.32	1.42
K-feldspar.....	56.02	21.44	23.53	35.63	60.78	25.59	24.65	29.85	p	9.81	5.97	5.37	p	4.12
Albite.....	19.32	51.54	47.51	37.59	16.91	46.10	42.02	45.63	51.85	46.25	68.70	35.32	55.29	—
Oligoclase.....	—	—	—	—	—	—	—	—	—	—	—	—	—	61.77
Labradorite.....	—	—	0.87	2.20	—	3.38	5.98	1.11	13.59	14.71	9.04	39.27	22.11	—
Hornblende.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chlorite.....	2.99	5.36	7.79	5.62	3.45	8.28	13.71	8.32	19.76	16.67	7.61	12.35	18.16	5.83
Biotite.....	—	—	—	—	—	—	—	—	1.33	1.33	—	p	p	26.22
Augite.....	—	p	—	p	—	p	p	p	p	p	—	—	—	—
Muscovite.....	—	p	p	p	p	p	p	p	p	p	p	p	p	p
Apatite.....	p	p	p	p	p	p	p	p	p	p	p	p	p	p
Zircon.....	p	p	p	p	p	p	p	p	p	p	p	p	p	p
Fluorite.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Garnet.....	—	—	—	—	—	—	—	—	—	—	1.14	—	—	—
Sphene.....	p	p	p	p	p	p	p	p	p	p	—	p	p	—
Pistacite.....	—	—	p	p	p	p	p	p	p	p	—	—	—	—
Zoisite.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Allanite.....	p	p	p	p	—	p	p	p	p	p	p	—	—	—
Schorlite.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Pyrite.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Magnetite.....	p	p	p	p	p	p	p	p	p	p	p	p	p	0.65
Hematite.....	p	p	p	p	p	p	p	p	p	p	p	p	p	—
Leucoxene.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Calcite.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Kaolin.....	p	p	p	p	p	p	p	p	p	p	p	p	p	p
Sericite.....	p	p	p	p	p	p	p	p	p	p	p	p	p	p
Accessories.....	p	0.24	0.14	p	p	p	0.33	0.26	0.63	p	p	1.02	1.10	p
	100.00	99.99	100.02	100.01	100.00	100.00	100.00	99.99	99.99	100.00	100.01	100.01	99.98	100.01

p = present

309. Leucogranite
 198. Granodiorite
 191. Porphyritic granodiorite
 246. Adamellite
 300. Leucogranite

302. Granodiorite
 250. Granodiorite
 241. Adamellite
 B-N. Tonalite

305. Tonalite
 257. Granodiorite
 279. Melagranodiorite
 173. Tonalite
 190. Syenogabbro

observed in slightly less than 50% of the Cape Royds specimens. Twinned hornblendes, so commonly noted in West Antarctica rocks, are uncommon in those of East Antarctica.

A review of the literature discloses that allanite is practically confined to rocks of East Antarctica. The only references to this mineral in West Antarctica are recorded by Pelikan (1909, p. 36) in a kersantite collected in Osterrieth Mountains, Anvers Island, Palmer Archipelago, and by Stewart (1945a, p. 147; 1947, p. 230) in intrusives of the Melchior Islands, Palmer Archipelago. Allanite and allanite (?) are observed in 8 of 125 thin sections.

Allanite in Antarctic rocks was first reported by Prior (1902, p. 323) in descriptions of a biotite granite boulder found on the plateau of Cape Adare, Victoria Land, and a boulder of biotite-hornblende granite from "Geikie Land" (Geikie Ridge), collected by the Southern Cross Antarctic Expedition, 1898-1900.

Prior (1907, p. 127), describing the rocks collected by the National Antarctic Expedition, 1901-4, refers to allanite in specimens from Cathedral Rocks, Victoria Land. Mawson (1916, p. 211), in his descriptions of rocks collected from the mainland of Victoria Land by the British Antarctic Expedition, 1907-9, states, "Allanite is by far the commonest of the accessory minerals appearing in nearly all the granites in our collections." On page 217, he refers to allanite in aplitic granite porphyry. Cotton (1916, p. 235-236) mentions allanite (?) in an augite porphyryite from Cape Ross, south of Depot Island, Victoria Land. Smith (1924, p. 183), in referring to hornblende biotite granites of Granite Harbour and Ferrar Glacier areas, McMurdo Sound, Victoria Land, states, "Allanite (orthite) was found as an accessory in all typical specimens." In this same publication, page 185, he remarks that orthite as thin prisms (0.6 mm. \times 0.06 mm.) is a rare but constant accessory in aplite and pegmatite dikes of the McMurdo Sound region. He, also, reports allanite in quartz-orthoclase porphyries and mentions the mineral as a constant accessory in orthoclase porphyries. Biotite and hornblende biotite granites contain allanite in the Terra Nova Bay region, Victoria Land.

Although Wade (1937) and Warner (1945) do not record allanite in their thin sections, Stewart (1945b) reports allanite in 9 of 30 slices of quartz-bearing intrusives from Marie Byrd Land, which rocks show affinities with both East and West Antarctica types.

Wade (1945) did not observe allanite in rocks of the Rockefeller Mountains, Edward VII Peninsula, nor did Stewart (1945b).

The occurrence of allanite is notable in the specimens collected by the Australasian Antarctic Expedition, 1911-14, from Adélie, George V, and eastern Queen Mary Coasts, as recorded in the writings of Glastonbury (1940a, b, c), Kleeman (1940), Nockolds (1940), Stillwell (1918, 1923), and Summers and Edwards (1940). Allanite is reported in granite, felsite, porphyry, granophyre, metamorphosed dolerite, gneiss, hybrid gneiss, schist, amphibolite and marble. On page 52, in describing the rocks of eastern Queen Mary Coast, Nockolds states, "A feature of this province, if province it can be called, is the universal presence of orthite in all acid rocks."

Although Woolnough (1916) does not mention the occurrence of allanite in Cape Royds erratics, a distinguishing feature of this suite from Cape Royds is the presence of allanite, being observed in 52 sections of acid igneous rocks and three of intermediate composition, as well as in eight gneisses and two schists. Allanite exhibiting neither twinning nor zoning is seen in 10 sections; zoned and twinned in 33 slides; zoned only in 19 thin sections, and twinned only in two slices.

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REFERENCES

- BENSON, W. N. (1916), Report on the petrology of the dolerites collected by the British Antarctic Expedition, 1907-1909, *British Antarctic Exped. 1907-1909, Rep. Sci. Investigations Geol.*, 2, pt. 153-160.
- COTTON, L. A. (1916), Petrographical notes on some rocks retrieved from the cache at Depot Island, Antarctica, *British Antarctic Exped. 1907-1909, Rep. Sci. Investigations Geol.*, 2, Appendix pt. 13, 235-237.
- GLASTONBURY, J. O. G. (1940a), Acid effusive and hypabyssal rocks (from the moraines), *Austral. Antarctic Exped. 1911-1914, Sci. Rep.*, ser. A, 4, *Geol.*, pt. 4, 115-134.
- (1940b), Metamorphosed limestones and other calcareous sediments from the moraines, a further collection, *Austral. Antarctic Exped. 1911-1914, Sci. Rep.*, ser. A, 4, *Geol.*, pt. 8, 295-322.
- (1940c), Some hybrid gneisses from the moraines, Cape Denison, *Austral. Antarctic Exped. 1911-1914, Sci. Rep.*, ser. A, 4, *Geol.*, pt. 9, 325-333.
- JENSEN, H. I. (1916), Report on the alkaline rocks of Mount Erebus, Antarctica, *British Antarctic Exped. 1907-1909, Rep. Sci. Investigations Geol.*, 2, pt. 7, 93-128.
- KLEEMAN, A. W. (1916), Schists and gneisses from the moraines, Cape Denison, Adelie Land, *Austral. Antarctic Exped. 1911-1914, Sci. Rep.*, ser. A, 4, *Geol.*, pt. 7, 197-292.
- MAWSON, DOUGLAS (1916), Petrology of rock collections from the mainland of South Victoria Land, *British Antarctic Exped. 1907-1909, Rep. Sci. Investigations Geol.*, 2, pt. 13, 201-234.
- NOCKOLDS, S. R. (1916), Petrology of rocks from Queen Mary Land, *Austral. Antarctic Exped. 1911-1914, Sci. Rep.*, ser. A, 4, *Geol.*, pt. 2, 15-86.
- PELIKAN, A. (1909), Géologie, Petrographische Untersuchung der Gesteinsproben, Expédition Antarctique Belge, Résultats du Voyage du *S.Y. Belgica* en 1897-1898-1899 sous le commandement de A. de Gerlache de Gomery, *Rap. Sci.*, 1, 1-49.
- PRIOR, G. T. (1902), Report on rock specimens collected by the Southern Cross Antarctic Expedition, *Rep. Southern Cross Collections (British Museum)*, 321-332.
- (1907), Report on the rock specimens collected during the *Discovery* Antarctic Expedition 1901-1904, *National Antarctic Exped. 1901-1904, Nat. Hist.*, 1, *Geol.*, 101-140.
- SMITH, W. CAMPBELL (1924), The plutonic and hypabyssal rocks of South Victoria Land, *British Antarctic (Terra Nova) Exped. 1910, Nat. Hist. Rep. Geol.*, 1 (6), 167-227.
- (1954), The volcanic rocks of the Ross Archipelago, *British Antarctic (Terra Nova) Exped. 1910, Nat. Hist. Rep. Geol.*, 2 (1), 1-107.

- STEWART, DUNCAN, JR. (1945a), Preliminary report on some intrusives of the Melchior Islands, Antarctica, *Proc. Amer. Phil. Soc.*, **89** (1), 146-147.
- (1945b), The petrography of some intrusive rocks from Edward VII and Marie Byrd Lands, *Proc. Amer. Phil. Soc.*, **89** (1), 148-151.
- (1947), Rocks of the Melchior Islands, Antarctica, *Proc. Amer. Phil. Soc.*, **91**, 229-233.
- STILLWELL, F. L. (1918), The metamorphic rocks of Adelie Land, Sect. 1, *Austral. Antarctic Exped. 1911-1914, Sci. Rep.*, ser. A, *Geog., Physiog., Glaciol., Oceanog., and Geol.*, **3**, pt. 1, 1-230.
- (1923), Amphibolites and related rocks from the moraines, Cape Denison, Adelie Land, *Austral. Antarctic Exped. 1911-1914, Sci. Rep.*, ser. A, *Geol.*, **3**, pt. 4, 259-280.
- SUMMERS, H. S., AND A. B. EDWARDS (1940), Granites of King George Land and Adelie Land, with an appendix by A. W. Kleeman, *Austral. Antarctic Exped. 1911-1914*, ser. A, *Geol.*, **4**, pt. 3, 87-113.
- THOMSON, J. A. (1916), Report on the inclusions of the volcanic rocks of the Ross Archipelago, *British Antarctic Exped. 1907-1909, Rep. Sci. Investigations Geol.*, **2**, pt. 8, 129-148.
- WADE, F. A. (1937), Petrologic and structural relations of the Edsel Ford Range, Marie Byrd Land, to other Antarctic mountains, *Bul. Geol. Soc. Amer.*, **48**, 1387-1396.
- (1945), The geology of the Rockefeller Mountains, King Edward VII Land, Antarctica, *Proc. Amer. Phil. Soc.*, **89** (1), 67-77.
- WALKOM, A. B. (1916), Report on the pyroxene granulites collected by the British Antarctic Expedition, 1907-1909, *British Antarctic Exped. 1907-1909, Rep. Sci. Investigations Geol.*, **2**, pt. 10, 161-168.
- WARNER, L. A. (1945), Structure and petrography of the Southern Edsel Ford Ranges, Antarctica, *Proc. Amer. Phil. Soc.*, **89** (1), 78-122.
- WOOLNOUGH, W. G. (1916), Petrological notes on some of the erratics collected at Cape Royds, *British Antarctic Exped. 1907-1909, Rep. Sci. Investigations Geol.*, **2**, pt. 11, 169-188.

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