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The geochemistry of Lower Tertiary basic dykes in the Eastern Red Hills district, Isle of Skye, and their significance for the proposed magmatic evolution of the Skye Centre

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ABSTRACT. Major- and trace-element data are presented for basic dykes intruding the Eastern Red Hills district of the Tertiary igneous centre of Skye. In addition to a group of transitional basic intrusions, members of two other distinctive suites have been identified: (1) a series of basic alkaline intrusions (akin to the 'Beinn Dearg Type' of Harker, 1904), with characteristic high alkali contents, distinctive values of $K_2O/(K_2O+Na_2O)$ and rare-earth-element (*REE*) patterns similar to those of many of the Tertiary lavas of north Skye, and, (2) tholeiitic dykes, with low concentrations of K_2O, Ti/Zr values of *c.* 100, and flat *REE* patterns similar to those of the so-called Fairy Bridge magma type (Mattey *et al.*, 1977). From these data and a consideration of the time relationships of the various components of the Skye Centre, agreement is found with Thompson *et al.*'s (1972, 1980) model of a mantle thermal anomaly which generates the magmatic sequence: transitional basic magmas, giving way to olivine-bearing tholeiitic magmas (at the culmination of the anomaly), and, finally, late-stage basic alkaline magmas at the end of the activity.

NUMEROUS basic dykes intrude the various rocks of the Eastern Red Hills district of the Lower Tertiary igneous centre of Skye. Most appear to be members of the NE-SW regional swarm of the centre (Harker, 1904), and are therefore not considered to be intimately related with the magmatism of the Eastern Red Hills focus of intrusive activity. As has been noted in several previous studies of parts of the Skye Centre (e.g. Bell, 1959; Thompson, 1965; Jassim, 1970), the time-relationships of the various minor intrusions are often impossible to elucidate. Therefore, in the case of the basic minor intrusions described below, they will be discussed in terms of the rocks they are seen to intrude, and hence post-date. In a subsequent section, their mineralogy, and, in more detail, their chemical affinities will be considered, where it will be shown that several of these basic dykes form part of a distinctive suite with alkalic affinities. Tholeiitic dykes are less common.

The proposed groupings are: (1) Slightly porphyritic, fine-grained dolerites (post-Inner Granite); (2) Basalt dykes, with rare phenocrysts of plagioclase (post-Outer Granite); (3) Various dykes (both basaltic and doleritic) which intrude the pyroclastic rocks of the Kilchrist area, as well as a thin inclined sheet which also cuts these pyroclastic rocks; and, (4) Dolerite dykes which intrude the gneiss and lava pile of Creagan Dubh.

The distribution of these intrusions is shown in fig. 1. Representative analyses of these rocks are presented in Table I and in the text, where designations such as B21 and B99 refer to specific analyses of samples.

In the first of the proposed groupings, the dykes intrude the Inner Granite. Eight of the ten dykes encountered are located NNW of the summit of Beinn Dearg Mhor and appear to form a distinctive group, both in terms of their field relationships and their chemical characteristics (see below). All are fine to medium in grain size, weather easily and range in width from 1.5-4 m. They do not tend to stand proud, are typically vertical and are conspicuous by their straightness. Another member of this group, located to the SE of Beinn Dearg Bheag (B196) forms a prominent gully, has distinctive spheroidal weathering characteristics and a general appearance very similar to the eight dykes noted above. The only other dyke in this group is a multiple intrusion (B21), 18-20 m wide and trending WNW, which forms a prominent feature on the east side of Beinn na Caillich. Nine of these ten post-Inner Granite dykes have been grouped together (see next section) and they typically have a brownish, slightly weathered appearance in

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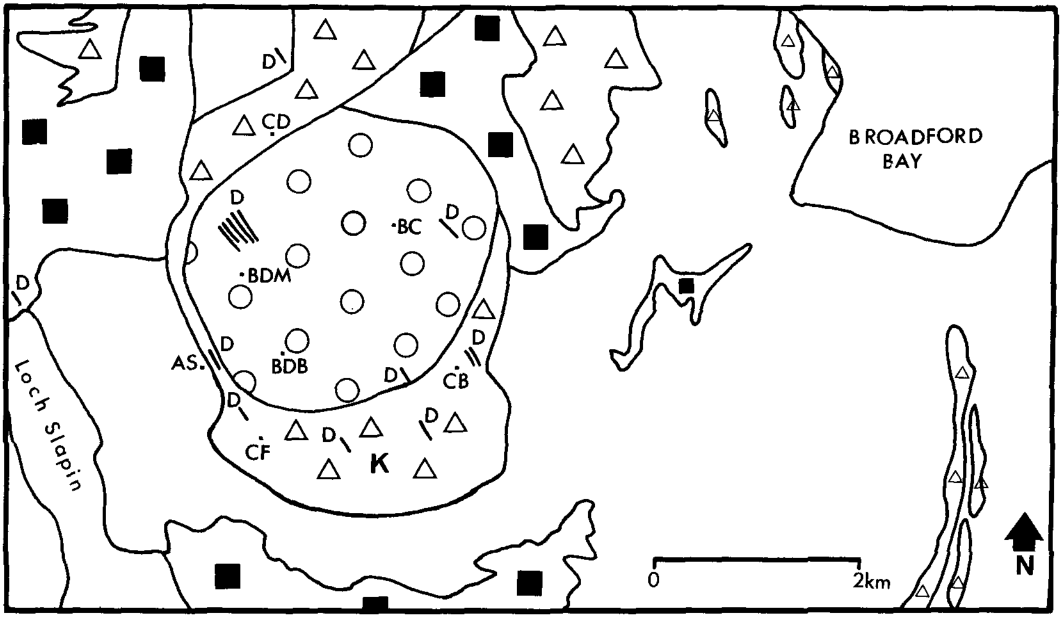

FIG. 1. Map of the Eastern Red Hills area of Skye illustrating the distribution of the basic minor intrusions (D). Key to symbols and letters: open circles = Inner Granite; filled squares = Outer Granite; open triangles = Other Tertiary igneous rocks; blank = pre-Tertiary country-rock; CF = Cnoc nam Fitheach; CD = Creagan Dubh; AS = Allt Slapin; BDM = Beinn Dearg Mhor; BC = Beinn na Caillich; BDB = Beinn Dearg Bheag; CB = Coire Beithe; K = Kilchrist area (south of Beinn Dearg Mhor and Beinn Dearg Bheag).

hand-specimen, with visible phenocrysts of plagioclase and rare olivine. Towards their margins no discernible chilling is seen, but the presence of zeolite-filled cavities (amygdales) is common in a number of the dykes (e.g. B266, B269).

Two fine-grained (basaltic) dykes (< 1 m thick) compose Group 2 and were found intruded into the Outer Granite. Although not studied in detail because of bad exposure, it appears that they are vertical and have trends parallel to the Skye regional swarm.

The group listed under (3) is of a mixed nature, consisting of an equigranular dolerite (B99), a coarse-grained mugearite (B101), a feldspar-phyric fine-grained dolerite (B201), an irregular intrusion of altered dolerite (B244), an altered basaltic dyke (B242), and a group of relatively pale-coloured dykes (hawaiites and mugearites) of coarse grain size in Coire Beithe, SE of Beinn na Caillich (B216, B218, B219, and B220). The four dykes in Coire Beithe are exposed in a small gully and tend to stand proud of the pyroclastic rocks which they intrude. Phenocrysts of plagioclase are not uncommon in these dykes. From their trends these dykes also appear to be members of the Skye regional swarm. The thin basic sheet that has been included in this group is located WNW of Cnoc nam Fitheach in the Kilchrist area.

Finally, dykes belonging to Group (4) appear to be relatively common. They are generally doleritic in nature, with rare phenocrysts of plagioclase and olivine (frequently altered), and do not tend to stand proud where exposed on flat surfaces. As a group they are best observed below Creagan Dubh, where they typically weather out, forming 2–3 m wide gullies. On average, members of this group have widths of < 3 m, are vertical and trend parallel to the regional swarm. On considering the number exposed along the Creagan Dubh section (at least 20) and comparing this number with the figure obtained from the Inner Granite area further along the regional swarm trend (to the SE) where eight dykes have been recorded (see fig. 1), one is lead to conclude that many of the basic dykes of the regional swarm were intruded prior to the emplacement of the granite(s). Harker (1904, p. 292) also concluded from his field observations that the number of basic dykes intruded into the granites was small when compared to the number cutting the earlier basic complex of the Black Cuillin and the plateau lavas. However, Harker suggested that this was in some way related to the difficulty which

TABLE I. Major- and trace-element data for Eastern Red Hills basic dykes: (1) Post-Inner Granite; (2) Post-Outer Granite; (3) Post-pyroclastic rocks; (4) Dyke intruded into the basement gneiss of Creagan Dubh (see text for details); plus data for a post-Western Red Hills granite alkalic dyke (SK617) (data from Thompson *et al.*, 1972, 1980). Fe_2O_3/FeO normalized to 0.15

	(1)										(2)		(3)								(4)	
	B21	B196	B265	B266	B267	B268	B269	B270	B271	B272	B39	B42	B201	B216	B218	B219	B220	B232	B99	B101	B290	SK617
MAJOR ELEMENTS (Wt.%)																						
SiO_2	46.86	44.19	46.45	50.74	51.39	49.51	47.15	49.14	49.27	51.90	51.16	46.51	45.01	50.06	47.84	45.10	49.06	47.25	46.06	51.32	47.55	45.18
TiO_2	1.13	2.28	2.11	1.72	1.84	2.40	2.78	2.27	1.71	1.62	0.96	2.33	2.37	2.30	2.04	2.50	2.01	2.75	2.02	1.84	2.04	1.57
Al_2O_3	16.22	15.96	17.55	15.77	16.32	15.54	15.59	15.03	16.63	16.93	14.85	13.43	16.14	16.20	15.24	14.87	15.89	15.16	14.42	12.80	13.91	14.83
Fe_2O_3	1.45	1.66	1.55	1.64	1.66	1.60	1.74	1.73	1.47	1.49	1.27	1.97	1.57	1.60	1.61	1.69	1.53	1.67	1.90	1.51	1.83	1.50
FeO	9.70	11.03	10.33	10.91	11.06	10.70	11.60	11.54	9.82	9.90	8.47	13.12	10.47	10.70	10.76	11.29	10.19	11.13	12.69	10.09	12.18	8.92
MnO	0.17	0.20	0.22	0.32	0.31	0.26	0.25	0.28	0.23	0.25	0.17	0.22	0.20	0.31	0.32	0.26	0.29	0.27	0.20	0.25	0.25	0.19
MgO	9.45	5.44	4.16	1.90	1.56	2.27	4.07	2.28	2.18	1.59	5.24	4.17	4.77	1.99	3.65	5.06	2.54	2.50	5.18	3.05	5.43	11.75
CaO	12.70	8.71	10.64	5.29	6.22	5.69	8.67	5.58	7.08	3.04	9.68	10.65	11.14	6.39	7.21	9.77	6.51	8.31	10.36	6.64	10.24	11.32
Na_2O	2.12	3.41	3.47	4.82	5.39	4.50	4.06	4.06	4.44	5.86	1.96	1.59	2.19	5.28	4.05	2.93	4.27	2.87	1.76	2.84	1.92	2.04
K_2O	0.36	1.16	0.82	1.86	1.90	1.61	1.22	2.01	1.67	1.98	1.30	1.00	0.86	1.91	1.67	1.02	2.14	1.90	0.17	1.73	1.01	0.47
Alk. Total	2.48	4.57	4.29	6.68	7.29	6.11	5.28	6.07	6.11	7.84	3.26	2.59	3.05	7.19	5.72	3.95	6.41	4.77	1.93	4.57	2.93	2.51
P_2O_5	0.05	0.22	0.34	0.71	0.83	0.53	0.30	0.72	0.50	0.64	0.07	0.30	0.19	0.59	0.53	0.21	0.56	0.43	0.21	0.74	0.30	0.17
H_2O^-	0.03	4.19	1.57	2.62	0.68	3.07	1.85	3.22	2.97	3.14	3.27	2.62	3.57	0.80	3.54	3.39	3.44	3.98	3.77	5.20	2.31	-
LOI	0.06	1.07	0.44	1.49	0.47	1.99	0.47	1.75	1.47	1.54	0.72	0.84	0.80	1.14	1.16	1.05	1.06	1.53	0.67	0.99	0.46	2.19
TOTAL	100.31	99.53	99.65	99.80	99.61	99.68	99.74	99.61	99.45	99.89	99.11	98.75	99.27	99.27	99.62	99.13	99.49	99.76	99.42	99.00	99.43	100.13
TRACE ELEMENTS (ppm)																						
Ba	224	521	349	637	678	615	592	644	918	655	124	147	269	435	609	504	707	866	69	858	221	137
Rb	8	48	21	57	56	48	35	56	32	38	27	106	24	23	38	23	52	55	20	46	50	12
Sr	265	520	437	414	389	526	427	689	430	415	173	195	324	231	557	460	541	438	209	231	185	386
Nb	9	33	33	42	57	52	38	52	51	78	10	7	25	34	52	21	46	50	8	18	12	9
Zr	69	169	199	415	445	336	226	386	334	507	164	345	163	211	235	150	348	302	126	464	163	84
Y	21	44	39	93	96	90	44	84	59	99	40	45	33	38	51	41	61	58	38	57	50	18
Th	3	1	2	3	5	2	3	3	3	5	5	2	2	2	2	3	3	3	3	4	4	0.83
Cu	150	78	73	9	26	19	43	23	30	23	81	67	82	13	52	62	20	16	84	21	83	-
Ni	162	90	48	6	5	4	51	6	20	6	83	41	73	3	55	50	16	4	71	28	71	-
V	223	252	228	33	35	41	96	21	98	40	207	430	300	99	168	295	97	157	407	181	372	-
Zn	58	70	76	107	118	99	84	102	80	108	80	103	68	60	85	81	94	95	107	111	126	-
Cr	291	119	89	8	11	11	100	14	41	12	86	113	119	11	103	62	24	14	109	26	135	-

basic magma had invading the granites. From the results of the present study it appears more likely that the reason for the differences in numbers is due to the fact that the granites were not emplaced until almost the end of the magmatic history of the Skye (and Eastern Red Hills) Centre (cf. Richey, 1939 and Speight *et al.*, 1982).

Mineralogy and geochemistry. Based on the results of an investigation of the whole-rock compositions of all the dykes described above it has been deduced that there are two distinctive groups—one alkalic and one tholeiitic.

The smaller tholeiitic group has as its most prominent member the large multiple dyke east of Beinn na Caillich. Typically, members of this group have a relatively distinctive mineralogy, although individual dykes exhibit gross variations in grain size. As a sub-group of the tholeiites, dykes represented by the specimens B21, B42, B99, and B290 are all true basalts, whereas B39 and B101 are more evolved.

The coarser members show the development of a distinctive ophitic texture and contain sparse phenocrysts of plagioclase (1-2 mm) and olivine microphenocrysts. In terms of the number of phases present these rocks are relatively uncomplicated. Euhedral plagioclase (An_{60-70}) occurs as quite fresh phenocrysts, whilst less calcic plagioclase is subophitically enclosed within plates of brown augite, the latter exhibiting complex zoning and overgrowths. Olivine, where relatively fresh, is similar in size to the groundmass plagioclase. It shows good crystal outlines, and in some cases contains fractures which are filled with chlorite, serpentine, and Fe-Ti oxides. Primary (magmatic) Fe-Ti oxides are not uncommon as skeletal grains similar in size to, or slightly smaller than the olivines and groundmass plagioclases described above. Also dispersed throughout some of the members of this group are small flecks of biotite, tending to occur as irregular overgrowths on Fe-Ti oxides, olivine, and pyroxene, some of it showing alteration to chlorite. The general paragenesis for this group appears to be olivine followed by plagioclase (both as phenocrysts), groundmass plagioclase, and pyroxene and Fe-Ti oxide, and finally (?) secondary biotite and secondary chlorite. Inclusion trails, typically parallel to the twin planes, have been observed in some of the plagioclase phenocrysts (e.g. B21). They have a glassy appearance, but their composition is not known at present.

The dykes with alkalic affinities form numerically the largest group. Petrographically they are almost identical to a group first defined by Harker (1904, p. 325) as the Beinn Dearg Type and are characterized in the Eastern Red Hills district by the group of dykes outcropping NNW of the summit of Beinn Dearg Mhor. It should be noted that Harker defined this group (or type) after the type locality of Beinn Dearg, Glen Sligachan,

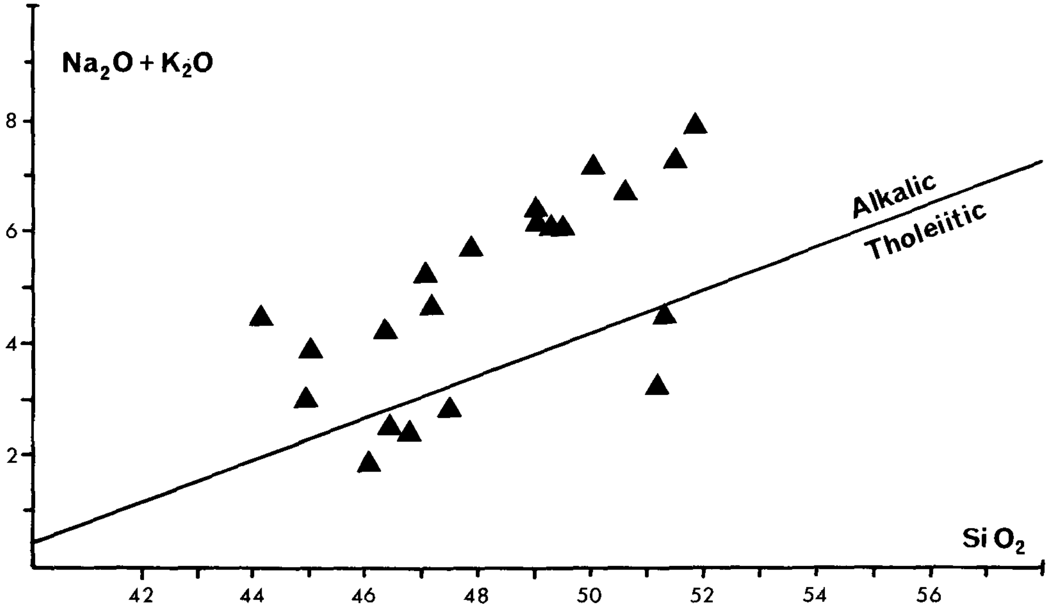

FIG. 2. Plot of Na_2O+K_2O *vs.* SiO_2 (wt. %) for Eastern Red Hills basic dykes. The boundary between the Hawaiian alkalic and tholeiitic fields is from Macdonald and Katsura (1964).

Western Red Hills, some 7 km west of the area under investigation.

In thin-section, the phenocrysts of feldspar (3–4 mm) are euhedral and zoned from An_{79-82} (core) to An_{55} (rim). Glassy inclusions, similar to those noted by Harker (1904, p. 326) are also present, but are not common. They appear to be aligned parallel to the twin planes and were probably included as the phenocrysts grew. The other main phenocryst phase (or, in some cases, microphenocrysts, 1–2 mm) is olivine (3–4 mm), which is totally pseudomorphed by serpentine, chlorite and Fe–Ti oxides. Primary zoning, enhanced by the development of these secondary products, is often visible. The groundmass is composed of plagioclase (An_{55-60}) in a sub-ophitic arrangement with purplish-brown, altered augite. Poorly developed olivine, again totally pseudomorphed, occurs enclosed in both groundmass phases (plagioclase and pyroxene) along with blades of apatite and euhedral to anhedral Fe–Ti oxides. Zeolite occurs as an interstitial phase. Secondary zeolite, often fibrous, is also present, lining vesicles at the margins of some of the dykes. The titaniferous nature of the pyroxene and the presence of interstitial and secondary zeolite tend to indicate the alkali-rich nature of these dykes, a feature which is made more obvious when their whole-rock chemistry is considered.

The chemical affinities of the Eastern Red Hills basic dykes are clearly illustrated in a plot of total alkalis (Na_2O+K_2O) *vs.* SiO_2 (fig. 2). Inspection of this diagram reveals that the majority of the dykes fall in the Hawaiian alkalic field of Macdonald and Katsura (1964). The presence of the pyroxene and zeolite (as noted above) acts as a good petrographic manifestation of the high alkalis that have been recorded from these dykes. The primary alkaline nature of these dykes is also borne out when consideration is given to the incompatible trace-elements Nb, Zr, and Y, all of which show comparatively high concentrations (Table I). Futhermore, in order to compare the relative amounts of K_2O and Na_2O, a plot of $K_2O/(K_2O+Na_2O)$ *vs.* SiO_2 (fig. 3) reveals that these dykes form a relatively distinctive group, with values of this ratio between 0.19 (B265) and 0.33 (B270). One anomalous value of 0.40 (B232) is difficult to explain in the light of other data. It is not likely to be due to Na loss via alteration—the rock is particularly fresh. From a consideration of its high Ba content (866 ppm) it is suggested that the K component of the feldspar is anomalous due to

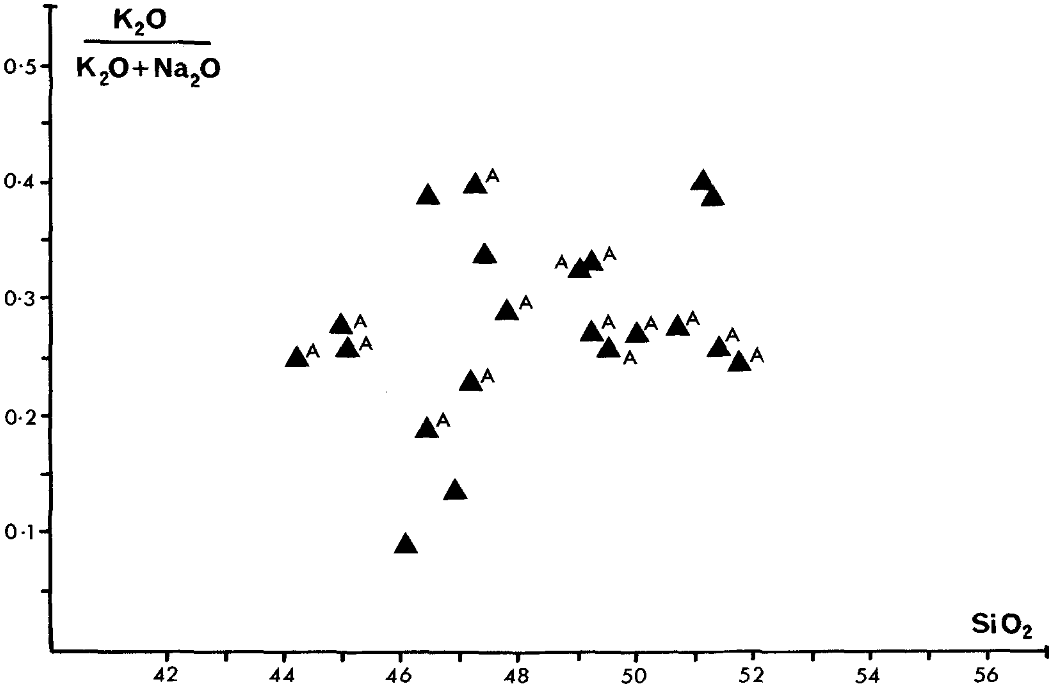

FIG. 3. Plot of $K_2O/(K_2O+Na_2O)$ *vs.* SiO_2 (wt. %) for Eastern Red Hills basic dykes. Points with the letter 'A' beside them plot in the alkalic field of fig. 2. The other dykes are either transitional or distinctly tholeiitic in nature.

late-stage magmatic crystallization, or that perhaps the crystallization of biotite brought about this peculiar $K_2O/(K_2O+Na_2O)$ ratio.

Those members which fall in the tholeiitic field of fig. 2 (B39, B42, B101, and B290) lie relatively close to the dividing line, and following the arguments of Thompson *et al.* (1972) it is concluded that, although they plot in this part of the diagram, they are in fact transitional in nature and compositionally akin to members of the Skye Main Lava Series (SMLS). Rocks of this group have $K_2O/(K_2O+Na_2O)$ values falling in the range 0.34–0.40. Only two dykes plotting in the tholeiitic field do not have values falling in this range [B21 (0.14) and B99 (0.09)]. Considering these two dykes first, it is noted that both have values of $K_2O/(K_2O+Na_2O)$ which are comparable with the Fairy Bridge basalt of Thompson *et al.* (1972) (sample SK 971), which has a value of 0.125. Other data representative of this group are presented in Table II. Both B21 and B99 have low concentrations of Nb, comparable with those of the Fairy Bridge basalt (although some members of the SMLS have similar values). However, if one considers the ratio Ti/Zr, noted by Mattey *et al.* (1977) to be high (*c.* 120) in the Fairy Bridge basalt type, inspection of the data in Table II indicates that B21 and B99 (with values of 98 and 96, respectively) are both akin to this group. Hence, if one considers this important parameter along with their low concentrations of K_2O (Table II) and low $K_2O/(K_2O+Na_2O)$, it is concluded that both dykes are members of the Fairy Bridge basalt magma type. As a further test of this conclusion, *REE* determinations were made on one of these dykes (B21) (fig. 4 and Table II) and revealed that it has a relatively flat chondrite-normalized pattern with $(Ce/Yb)_N = 2.08$, a value which is similar to that of the Fairy Bridge basalt determined by Thompson *et al.* (1980).

TABLE II: Selected major- and trace-element data for tholeiitic basic dykes from the Eastern Red Hills district and the type-locality Fairy Bridge lava of Thompson et al. (1972, 1980). B21, post-Inner Granite dyke; B99, post-pyroclastic rocks dyke; SK971, Fairy Bridge lava (data from Thompson et al., 1972, 1980).

	B21	B99	SK971
Ti/Zr	98	96	121
K_2O (wt.%)	0.36	0.17	0.43
$K_2O/(K_2O + Na_2O)$	0.14	0.09	0.12
Nb (ppm)	9	8	6
TiO_2 (wt.%)	1.13	2.02	1.37
$(Ce/Yb)_N$	2.08	-	1.72

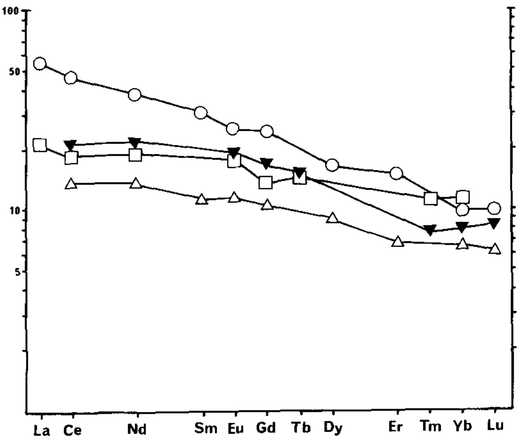

FIG. 4. Chondrite-normalized (Nakamura, 1974) *REE* plots for basic dykes from the Eastern Red Hills district, plus other basic rocks associated with the Skye Centre. Key to symbols: open circle = post-Inner Granite basic alkaline dyke (B196); open triangle = post-Inner Granite basic tholeiitic dyke (B21); filled triangle = post-Western Red Hills granites basic dyke (SK617*); open square = Fairy Bridge basic lava (SK971*). * Data from Thompson *et al.* (1980).

Although the existence of alkalic basic dykes of the type described above has been recognized since the studies of Harker (1904), very little has been published about their whole-rock compositions. Harker (1904, p. 325) and Thompson *et al.* (1972, p. 249 and 1980, p. 268) provide the only two published analyses. Table I lists the analysis by Thompson and his co-workers, along with the analyses of the Eastern Red Hills group. From these data the general trends of the suite (with respect to SiO_2) can be clearly seen. These trends are, as SiO_2 increases: increases in Al_2O_3, MnO, and P_2O_5, decreases in MgO and CaO and dramatic increases in Na_2O and K_2O. The decrease in MgO and CaO with increases in Na_2O and K_2O is typical of most fractionation sequences, usually indicating a decrease in the modal percentages of olivine, plagioclase and pyroxene and the concomitant increase in alkali feldspar and feldspathoids/zeolites.

From fig. 5 it can be seen that the variation of Al_2O_3, TiO_2, total FeO, CaO, MgO, Na_2O, K_2O, MnO, P_2O_5, and total alkalis with SiO_2 produces relatively straight lines, suggesting that they are members of a co-genetic suite. The curvature in the CaO line may be due to the relative fractionation of plagioclase and pyroxene (both Ca-bearing), whilst the dip in total FeO and TiO_2 at B271 suggests fractionation of Fe–Ti oxides. The low MgO content (compared with the analysis of Thompson and his co-workers) reflects the evolved nature of many

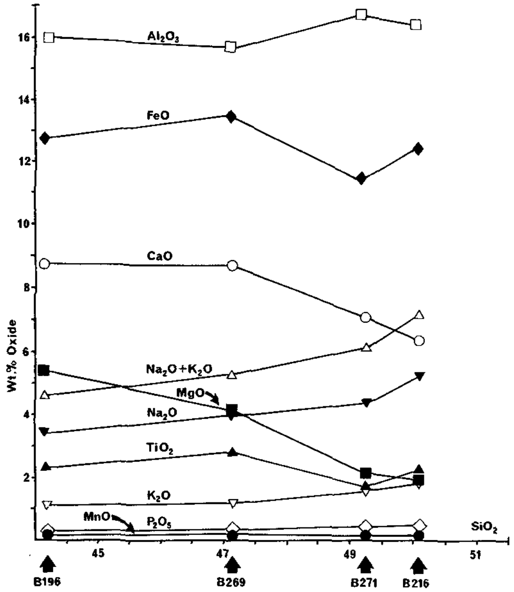

FIG. 5. Variation diagram for basic alkaline dykes from the Eastern Red Hills district (SiO_2 in wt. %).

of these dykes, where olivine has been severely fractionated.

The *REE* pattern for B196 (fig. 4), typical of the alkalic dykes from its major-element chemistry, shows similarities with both the post-Western Red Hills alkalic dyke and members of the SMLS, all of which are thought to have had similar parental magmas (see below). Therefore, as members of both groups (the alkalic dykes and the SMLS) show a similar light-*REE* enrichment, it is not possible to discriminate between the two groups on the basis of their respective *REE* patterns. As has been noted above, this is more easily done on the basis of their total alkali content and values of the ratio $K_2O/(K_2O+Na_2O)$.

Petrogenetic significance. The role played by the various parental magmas associated with the Skye Centre has already been discussed by Thompson *et al.* (1972, 1980). The only group of basic rocks which have evolved from a mantle-derived parent and have not been discussed in detail is that of the alkalic dykes (the so-called 'Beinn Deag Type' of Harker, 1904).

Thompson *et al.* (1972, 1980) have proposed a model for the evolution of the Skye Centre, axiomatic to which is some form of thermal anomaly in the mantle below Skye during Lower Tertiary times. Briefly, it is suggested that at the beginning of the period of magmatic activity low degrees of partial melting gave rise to the parental magmas of the transitional SMLS, followed, at the peak of the thermal anomaly (with larger degrees of partial melting), by the precursor of the low-alkali, high-calcium olivine tholeiites (Preshal Mhor and Fairy Bridge magma types). This gave way to lower degrees of partial melting as the thermal climax was passed, producing late-stage magmas which are thought to have their most obvious manifestation in the alkalic (Beinn Dearg Type) dykes which have been described.

Harker (1904, p. 326) concluded that '. . . The Beinn Dearg type represents a highly specialized derivative from the hypothetical common stock (of magma)'. Furthermore, as most of the dykes of this type which he identified cut the late-stage granites, he concluded that they were intruded towards the end of the magmatic activity of the Skye Centre.

In a study of north Skye lavas, Thompson *et al.* (1972) proposed a model for the evolution of the magmatism in terms of the partial melting of mantle spinel-lherzolite. Thompson *et al.* (1972, p. 251) suggested that 'The chemistry of these dykes seems to fit well with their geological position at the end of the igneous sequence. As the thermal event beneath Skye ended, the tectonic processes speeding the tholeiitic magmas upwards from the upper mantle into the crust would become less active. Pools of hypersthene-normative picrite magma might gradually come to remain stagnant or semi-stagnant near their source regions and to cool slowly there. At these pressures they would probably fractionate by the separation of eclogitic assemblages and their residua become nepheline-normative and enriched in K, Ti, and P.' This model fits well with the chemistry and relative chronology (with respect to the rocks they intrude) of the alkalic dykes of the Eastern Red Hills district. Furthermore, it would appear that not only did the mantle-melt fractionate at depth to give the parental magma (possibly similar to the composition of SK 617, see Table I), but that further fractionation of olivine, pyroxene, and plagioclase in the upper crust gave rise to more evolved compositions (e.g. B272, with $SiO_2 = 51.9\%$ has $MgO = 1.59\%$ and total alkalis = 7.84%).

Thus, although the model of Thompson *et al.* (1972, 1980) for the late stages of Skye magmatic activity was proposed on the basis of only one chemical analysis, it would appear that from the evidence of the Eastern Red Hills district minor intrusions the model is greatly strengthened. From the above discussion it can be seen that although the alkalic dykes are not directly related to the Eastern Red Hills Centre, their relative commonness demonstrates the fact that batches of basic magma were still available after the emplacement of the granites (the last major subvolcanic phase of activity in the Skye Centre; Bell, 1976).

Furthermore, from the composition of the large basic dyke which cuts the Inner Granite (B21, see fig. 1), it is concluded that magma of the Fairy Bridge type was also available. A complex 'plumbing' system alluded to by Thompson *et al.* (1972, p. 247), consisting of '. . . a ramifying plexus of sub-volcanic conduits and fissures resembling a sponge, but without good lateral connections . . .' may well have existed beneath the Eastern Red Hills district towards the end of its magmatic history, allowing the intrusion of two distinctly different magma types at such a late stage.

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