Rare-earths concentrations in the South Ruri carbonatite in western Kenya

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552.1 : 546.65 : 552.331 (676.4)

The three major carbonatite complexes, Rangwa, Ruri and Homa Mountain, situated on the eastern shores of Lake Victoria, Kenya, lie almost on a straight structural line trending northeast parallel to, and south of, the Kavirondo Gulf. These carbonatites were covered by the regional mapping programme of the Geological Survey of Kenya[1–4] and they are at present under the detailed examination of members of the East African Geological Research Unit,[5–9] directed by Professor B. C. King, Bedford College, London University.

The Ruri Complex comprises the twin alkaline/carbonatite centres of North and South Ruri, two miles apart. South Ruri is nearly circular, being 2–3 miles in diameter, and is composed of syenites, phonolites, pyroclastic rocks and carbonatites intruded into up-domed Nyanzian metabasalt basement. The silicate rocks were emplaced about 11 m.y. ago, the carbonatites about 5 m.y. (radiometric determination by $K/^{40}Ar$ method).

A number of carbonatites, probably ring-dykes, have been recognized. All are calcitic, though ankeritic types may have been formed originally. They vary in appearance and in the different accessory minerals present. Minor ferruginous carbonatites occur marginally, and in one of these types rare-earths minerals have been discovered. Chip samples from two localities (*'A'* and *'B'*, Fig. 1) have been collected and analysed for their rare-earths content.

The rare-earth-bearing ferruginous carbonatite (now seen as alvikitic dyke-like bodies) was apparently emplaced after the intrusion of two early carbonatites, both of which pre-date the main carbonatite that constitutes the bulk of the mountain. The rare-earth-bearing carbonatite appears to be in structural conformity with this main carbonatite. At one locality (near *'B'*), the two appear to grade into one another, but at another locality xenoliths of the ferruginous carbonatite have been recognized in the main carbonatite, which must therefore be the later.

The appearance of the rare-earth-bearing carbonatite is variable, but characteristically it is a dark, often earthy-looking banded rock in which small discrete masses of magnetite can sometimes be seen. The banding, resulting from near-vertical streaming, ranges in colour from greys to light and dark browns, with thicknesses from a fraction of an inch upwards. This effect, however, is greatly enhanced by the presence throughout most of the rock of frequent yellowish streaks and thinner bands usually parallel to the main streaming. These latter features are up to ¼ in thick, but seldom persistent, passing into streaks or disseminations; some have a thread-like appearance. It is in this yellowish material, fine-grained and weathered-looking, that rare-earths concentrations have been found. Its distribution and slightly disturbed appearance suggest that this material represents a segregation from the parent ferruginous carbonatite before final emplacement and solidification.

In thin section the main part of the rock is seen to contain both clear calcite and calcite heavily stained with limonite; small but discrete masses of magnetite are abundant. Unlike the main carbonatites of Ruri, no pyroxene or biotite can be recognized, though small amounts of baryte, fluorite and francolite are present in some specimens. The streaks, representing highly weathered or altered material, tend to be isotropic. Certain structures within them, visible only under high power magnification, can be resolved into fibrous material set in an opaque background. Some of the forms are spherulitic, and having also a high birefringence, they resemble monazite. Bastnaesite may also be present. The rare-earth-bearing minerals are being determined and the results obtained will be published at a later date.

Bulk samples, composed of numerous chips removed at different parts of the locality, were collected from localities *'A'* and *'B'* and assayed at the Institute of Geological Sciences, London (Table 1).

Table 1 Analyses of rare-earth-bearing carbonatites from South Ruri, Kenya

			Locality *'A'*, %	Locality *'B'*, %
Total rare earths	+	ThO_2	4·52	5·64
containing		Eu_2O_3	0·07	0·07
		CeO_2	49·25	50·46
		Nd_2O_3	12·1	11·0
		Pr_6O_{11}	4·0	3·9

Individual rare earths are expressed as a percentage of total rare earths + ThO_2.
Eu_2O_3 was determined polarographically, CeO_2 absorptiometrically and Nd_2O_3 and Pr_6O_{11} absorptiometrically with a recording spectrophotometer.

The preliminary qualitative chip-sampling methods used in the field do not provide sufficient data to attempt an assessment of the reserves in rare earths of the two carbonatites around localities *'A'* and *'B'*. For

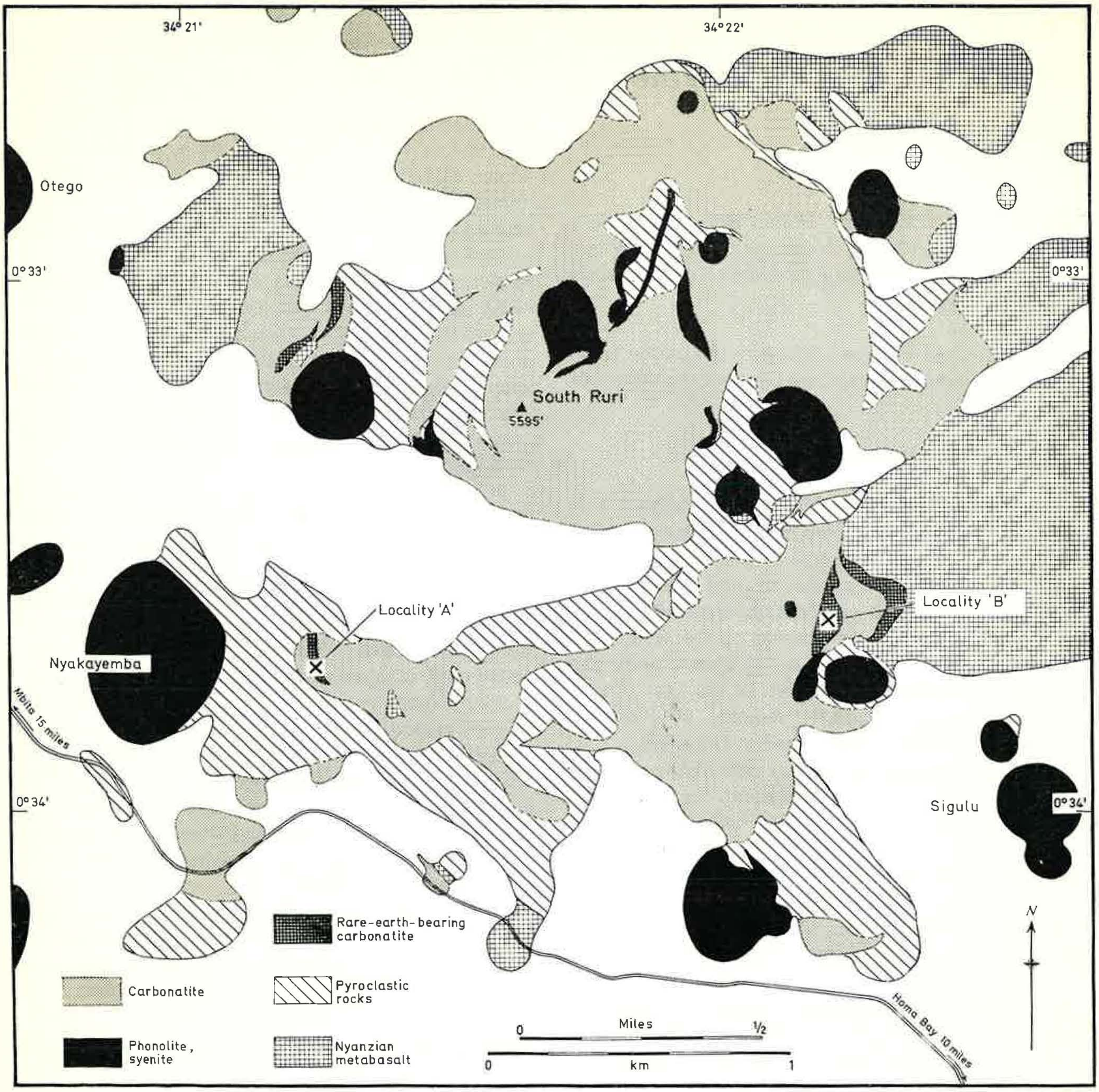

Fig. 1 Geological map of South Ruri showing location of rare-earth-bearing carbonatite

this purpose a more systematic surface sampling programme is required, coupled with shallow drilling, in order to determine the form and extension at depth of the rare-earths carbonatites themselves, and the possible variation at depth of their content in rare earths, which is unknown at present. If one admits for the time being that these carbonatites extend to a depth of 30 ft, a tonnage in the order of magnitude of 75 000 metric tons for locality *'A'* and 300 000 metric tons for locality *'B'* can be considered for the rare-earth-bearing carbonatites. In view of this rather limited tonnage, the economic potential of these carbonatites does not appear to be too encouraging, but further detailed field work is required to substantiate this statement.

It may be of interest to add that somewhat similar occurrences have been reported from the Homa Mountain carbonatite,[9] twelve miles northeast of South Ruri, but as they were not studied in detail no information on their tonnage and content in rare earths is available.

Acknowledgement

The authors, who in this note express only their personal views, wish to thank the Government of Kenya, and in particular Dr. J. Walsh, Chief Geologist of the Mines and Geological Department of Kenya, for permission to publish their observations. Thanks are also expressed to Dr. T. Deans, Institute of Geological Sciences, for his helpful advice and for providing the rare-earths analyses (Table 1) carried out by Miss E. Waine. Acknowledgements are due to the Age Determination Unit, Institute of Geological Sciences, for the age determination of the Ruri complex, and to Mrs. J. Crisford for the mineral separation work involved in it. One of the authors (B. C.) discovered the rare-earth-bearing carbonatites during a field survey carried out for the East African Geological Research Unit under the direction of Professor B. C. King, Bedford College, who kindly permitted the results to be published.

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Subsurface form of the Carn Brea granite, Cornwall

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551.243:552.331.1(423.7)

The Carn Brea granite of Cornwall constitutes a large portion of the Camborne–Illogan mining district. The geology of the area is well known (Fig. 1) and has been

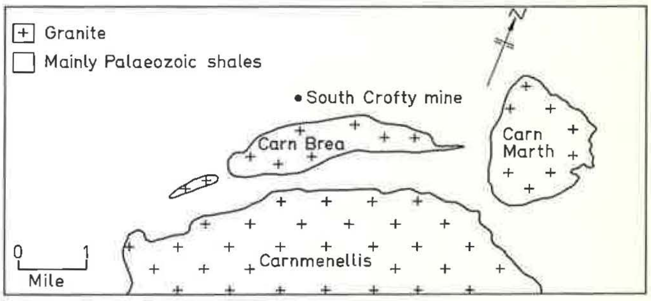

Fig. 1 General geology of Camborne–Illogan mining district, Cornwall

described by, among others, Hill and MacAlister,[1] Robson,[2] Llewellyn[3] and Dines.[4] Basically a series of Lower Palaeozoic argillaceous sediments, the Mylor Series has been intruded by a suite of basic dykes, and subsequently folded, fractured and faulted by extensive earth movements. The age of the earth movements is uncertain, some authorities having postulated both Caledonian and Hercynian influences,[2,5] whereas others favoured solely Hercynian.[6,7,8] It is clear, however, that the Mylor Series and its basic intrusives were subjected to deformation both prior to and during the intrusion of the Carn Brea granite, which is of late Hercynian/Permo–Carboniferous age.

Following the emplacement of the granite and its associated pegmatitic, aplitic and porphyritic intrusives, a group of hypothermal lodes was developed striking parallel to the granite ridge, and these were succeeded by a group with mesothermal characteristics striking at right angles to the ridge. It is from the hypothermal group that the renowned copper and tin ores of the district have been mined. The position of the Carn Brea granite is shown in Fig. 1; according to Robson,[9] it 'is in plan a lenticular mass 4 × $\frac{1}{2}$ miles attenuated to almost dyke-like dimensions at each extremity'. Mining operations have corroborated the ridge-like form, and have proved that the granite is joined to the Carnmenellis mass beneath a shallow trough of metamorphosed Mylor Sediments.

Mineralogically, the Carn Brea granite is very similar to that of Carnmenellis,[1] being essentially a holocrystalline, medium-grained grey muscovite–biotite–tourmaline granite of potassic nature. Common