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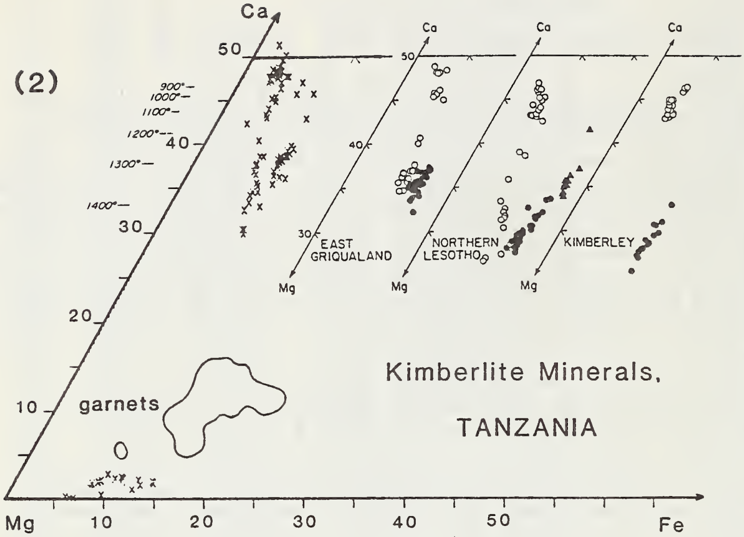
There are over 400 kimberlites in Tanzania (Wilson, 1982), including Mwadui, the largest pipe in the world. Published data are scarce reflecting the poor outcrop, sediment-filled craters and the unexcavated nature of the deposits. There have been few published petrographic data even from Mwadui, the only significant producer, since the pioneering study of Edwards and Howkins (1966). Few xenoliths have been described and appear to be rare although Williams (1932) illustrates eclogites from the Shinyanga District some of which could be grospyditic (Reid et al., 1976), and Boyd and Nixon (1970) give an analysis of a 'hot' subcalcic clinopyroxene discrete nodule from a heavy mineral concentrate. Here, we extend the study of concentrates from Kimberlites, with a view to determining the chemical and petrological nature of the Tanzania Craton and to assess its similarities or differences with respect to the much studied Kaapvaal Craton of southern Africa.

The samples are mostly in the size range 1-5mm, and are from a dozen or so kimberlites, mostly in the Mwadui area and to the south (Fig. 1). They are here treated together except where a significant local trend is observed.

The compositions of the silicates (Fig. 2) show broadly similar distribution fields to those observed in southern Africa kimberlites, an understanding of which enables an interpretation to be attempted. Clinopyroxenes and garnets are abundant, orthopyroxenes less so and olivines are absent. The main oxides are ilmenites and spinels.

Fig. 1. Tectonic map of East Africa after Nixon (in press) showing the outline of the Tanzanian Craton and major faults together with the distribution of kimberlites. Data mainly from Geological Survey sources, Williams (1939) and Edwards and Howkins (1966).

(2)



(3)

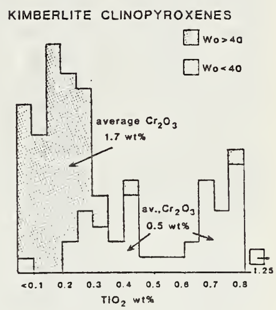


Figure 2. Range of compositions of silicate minerals in Tanzania kimberlite heavy mineral concentrates. The clinopyroxenes are compared with those from East Griqualand, northern Lesotho and Kimberley in southern Africa (see Boyd and Nixon, 1980, and references therein. The open circles are cpx compositions from garnet lherzolites; the close circles are from discrete nodules and the triangles from cpx intergrowths with ilmenite mostly lamellar). The garnet field excludes almandine varieties from the basement rocks. Orthopyroxenes are shown at the bottom of the diagram; olivines are absent.

Figure 3. Compositions of clinopyroxenes in Tanzania kimberlite heavy mineral concentrates.

Clinopyroxenes

Bright green Cr-rich and dark green Cr-poor diopsides are common, the former are calcic and Ti-poor and are similar to those of low temperature garnet lherzolite xenoliths. The latter are subcalcic and show a bimodal Ti distribution (Fig. 3). This is tentatively ascribed to derivation from high-temperature lherzolites (cf. the sheared xenoliths from Thaba Putsoa, Lesotho; Nixon and Boyd, 1973) and discrete nodules (megacrysts). Chromium values, however, are similar in both subgroups. Besides lower Ti the calcic clinopyroxenes are also depleted in Fe relative to the subcalcic types.

Orthopyroxenes

The chemical depletion is mirrored in the orthopyroxenes which range from enstatite to more fertile bronzite, the latter being relatively calcic and thought to have been in equilibration with the subcalcic ('hot') clinopyroxenes. Limited data indicate that the orthopyroxenes define PT points within the diamond stability field.

Garnets

Garnets with 70-80% pyrope typify the Tanzania concentrates. Purple low Ti Cr-rich varieties are similar to those from depleted lherzolites. Subcalcic Cr-rich pyropes (knorringite-rich) similar to those found as diamond inclusions are present. Several Cr garnets (Cr_2O_3 > 6 wt%) are also rich in TiO_2 (> 0.4 wt%). These may be part of the high-temperature lherzolite or discrete nodule (megacryst) suite. The latter are brown to red and usually range up to 1+ wt% TiO_2 and 2 wt% Cr_2O_3.

Ultra pyrope-rich (85% py) types may be from alkremites. Orange almandine-rich garnet with variable grossularite may be from basement granulites and from disaggregated eclogites (see comparable analysis in Reid et al., 1975).

Spinel

Inclusions in garnets typified by a pipe in the Nzega area show the following ranges, wt% analyses MgO, 9.2 - 12.2; Al_2O_3 12.1 - 14.6; Cr_2O_3, 55.4 - 58.4; FeO, 15.8 - 17.5 and negligible calculated Fe_2O_3. Discrete grains from Mwadui range to high values of Cr_2O_3 (62 wt%) and low Al_2O_3 similar to those found in diamond inclusions and subcalcic garnet harzburgites.

Ilmenites

These commonly show rinds of pimply perovskite. Compositional ranges of ilmenite vary to over 6 wt% Cr_2O_3 and 14 wt% MgO. Typical values are around 0.5 wt% Cr_2O_3 and 9 wt% MgO but pipes may have ilmenites showing a distinctive signature e.g. Mabuki, which shows a direct variation from about 1 to 3 wt% Cr_2O_3 and 4 to 9 wt% MgO.

Additional minerals observed and in most cases analysed include titaniferous magnetite, richterite amphibole, tremolite, zircon, phlogopite and apatite.

It is concluded that there are many similarities between the depleted lithosphere of Tanzania and southern Africa and that an ultradepleted basal layer exists. The effects of enrichment or metasomatism (phlogopite, richterite) were observed but the extent is unknown. The high temperature suite of inclusions, particularly those of the discrete nodule suite (subcalcic low Cr diopside, Ti pyrope, bronzite, ilmenite and zircon) can be matched with those erupted through the Kaapvaal Craton but there are differences in detail. We thank Williamsons Mine for assistance and samples.

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