23rd Colloquium of African Geology South Africa
January 8-14, 2011

ISOTOPE GEOCHEMISTRY OF SOME CARBONATITES FROM MOZAMBIQUE

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1. INTRODUTION

Several intrusive carbonatitic bodies occur in central-western Mozambique, and correspond to anorogenic igneous activities cutting through the Precambrian basement of the Mozambique Belt. Of these, the carbonatites of Xiluvo, Muambe, Muande, Fema and Rio Mufa were considered in this work. In addition, the much older and deformed Evate carbonatite was also studied, for comparison. The geological characterization of them can be found in Chaúque (2009). With the exception of the Evate carbonatite, the Mozambican bodies occur adjacent to the neighbouring country, Malawi (Fig.1), and also form part of the Chilwa Alkalin Province, defined by Bloomfield (1968) in the Malawian side, related to the East African Rift System, in the central-western part of Mozambique and Malawi. According to Real (1966), the carbonatites from the Mozambican territory show great petrographic affinity, not only among themselves, but also with known occurrences in the Malawian territory and must correspond the contemporaneous intrusions.The carbonatitic samples from Mozambique chosen for this study can be classified into two distinct groups: (i) samples of Xiluvo, Muambe and Evate, with calcite as the main carbonate and fine to medium-course textural varieties; (ii) samples of Muande Fema and Rio Mufa, have medium-fine to medium-course grained , with predominance or significant presence of dolomite. Xenomorphic carbonates are the most important mineral phases of all the studied samples.

2. GEOLOGICAL EVIRONMENT

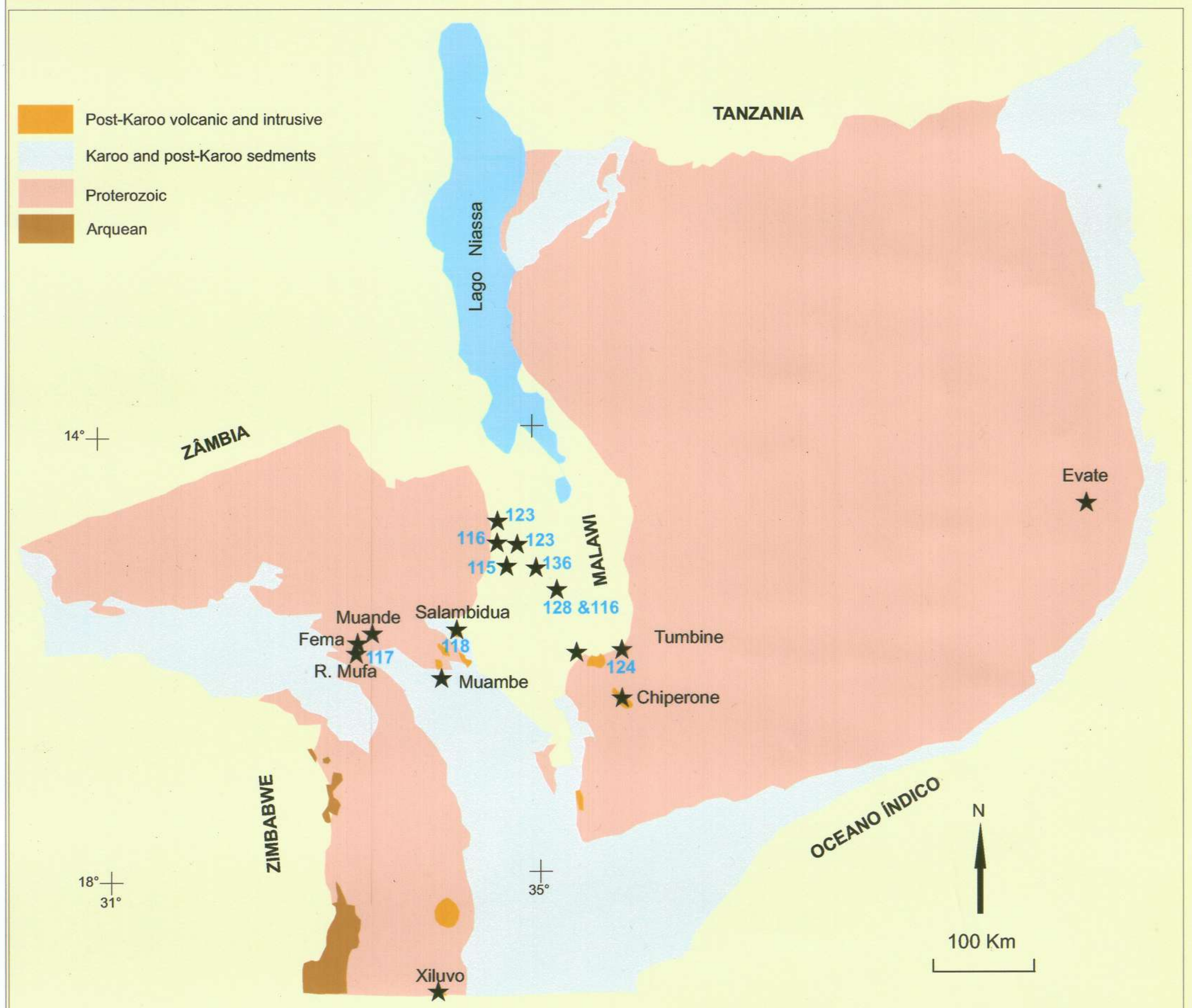

Fig.1. Location sketch of some carbonatitic and sienitic bodies from Mozambique and Chilwa Alcaline Province bilonging to Malawi. De numbers are age for million years.

The Cretaceous magmatism is represented by the plutonites and volcanites of the Shilwa Alcaline Province,which include carbonatites, kimberlites and alkali lavas. The Tumbine syenite,the Salambidwa syenitic-carbonatitic intrusion and the ring complexes of Muambe and Xiluvo also belong to the Chilwa Province. However the Chiperone syenite previously included in the same grouping, yilded Paleozoic K-Ar ages (Chaúque, 2009)on biotite and anphibole of about 400 and 450 Ma respectively.

3. LITHOGEOCHEMESTRY

This geochemical study of the carbonatitic magmatism from Mozambique is very preliminary, since only the samples chosen for this work were analysed for major and minor elements.They studie are essentially calcium-iron carbonatites. Incompatible elements are characterized in the appropriate diagrams by strong anomalies of Th, Y, Yb and by high content of P and Sr (Figure 2A). The REE spectra (Figure 2B) show LREE enrichment in all studied samples . Moreover, a few geochemical anomalies are registered, such as Cu and Co in the Rio Mufa, as well as V, Ni and Co in the Muande bodies.

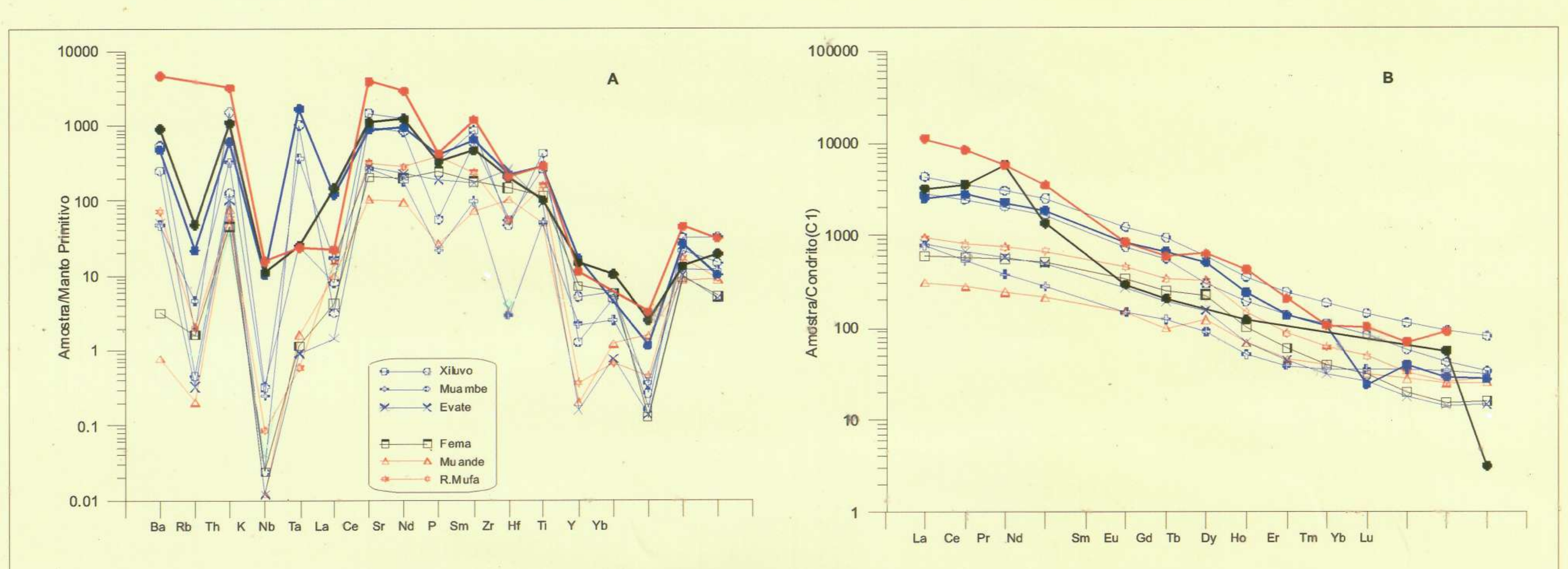

Fig.2 A- Multi-elements diagram of incompatible elements for carbonatitic rocks. Standardised Elements in relation to the primitive mantle (Sun & McDonough, 1989). Highlighted lines represents global average profiles of calciocarbonatite (blue), magnesiocarbonatite (black) and ferrocarbonatite (red), established by Woolley & Kempe (1989). B- Mmulti-elements diagram of rare earth elements for carbonatitic rocks. Standardised Elements according to the condrites C1 of Sun & McDonough (1989).

4. Sr-Nd ISOTOPIC GEOCHEMISTRY

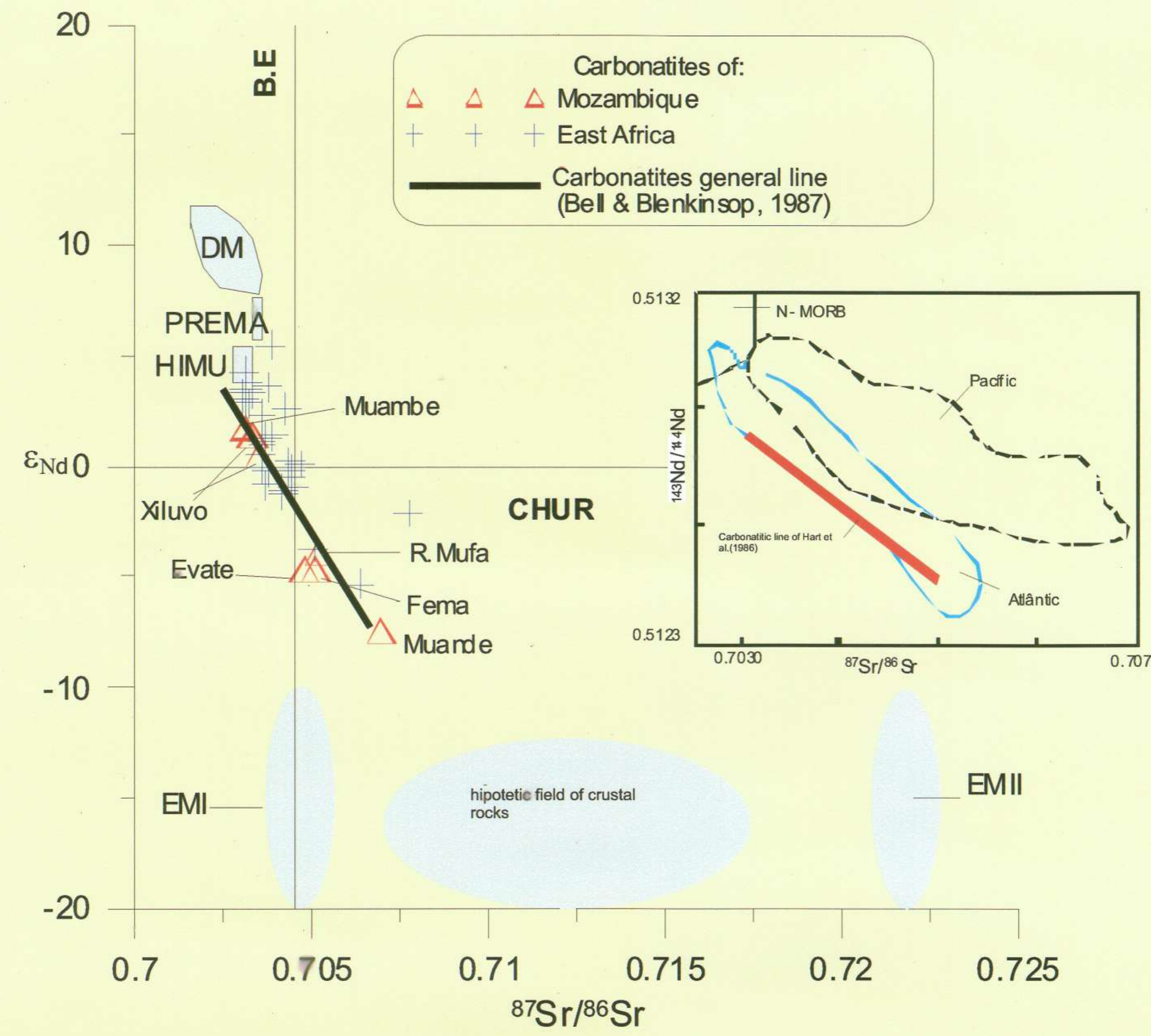

Fig.3. correlation Diagram of isotopes ε Nd(0) vs 87 86 Sr/Sr, showing the main reservoirs of Zigler & Hart (1986) and the projection of the reasons of carbonatitos of Mozambique and other regions of Eastern Africa (Uganda, Kenya, Tanzania, Zambia) including Namibia. DM, *depleted mantle*; PREMA, *PREvalent MAntle composition*; HIMU, *mantle with high U/Pb*; EMI and EMII, *enriched mantle*; CHUR, *Chondritic Uniform Reservoir;* B.E, *Bulk Earth*. Inserting shows line of carbonatites and data from some oceanic basalt (adapted from Bell & Blenkinsop, 1987).

In the diagram epslon Nd versus $^{87}Sr/^{86}Sr$ (Figure 2) were included, together with those obtained in samples of some other East African carbonatites (Kalt et al., 1997). In this figure, the group represented by Xiluvo and Muambe, as well as most other Eastern Africa carbonatites, occupies the upper left quadrant and the other four Mozambican samples (Evate, Muande Fema and Rio Mufa) are located in the lower right quadrant.

n this diagram the carbonatites exhibit a linear negative correlation, indicating the presence of at least two source types. One of them, corresponding to the Xiluvo and Muambe complexes, yields Sr/Sr values around 0.703 and positive epsilon Nd values, and is considered asthenospheric. For the other complexes, negative up to (-8) and moderately high Sr/Sr values between 0.705 and 0.708 are found (Table 1). This indicates sources with a complex magmatic history, formed either by a mixture of different components of asthenospheric and lithospheric mantle, or by assimilation of crustal material by the original magmas. This is similar to the conclusions given by Bell & Blenkinsop (1987) for a series of East African carbonatites with ages of 0 Ma.

Table 1-Sr and Nd isotopic data of some carbonatites from Mozambique.

Localidade	Rb (ppm)	Sr (ppm)	Sm (ppm)	Nd (ppm)	$^{87}Sr/^{86}Sr$	$^{143}Nd/^{143}Nd$	$\varepsilon_{Nd(0)}$	Error (Sr)	Error (Nd)
Xiluvo									
4/05	0.29	1184	116	788	0.703314	0.512708	1.37	0.000045	0.000008
5/05	1.13	7081	189	1183	0.703503	0.512666	0.55	0.000033	0.000008
Muambe									
010/06	2.97	468	22.7	132	0.703062	0.512729	1.77	0.000037	0.000009
Muande									
1FR	0.13	557	22.8	99.5	0.706940	0.512256	-7.46	0.000085	0.000010
Fema									
3FR	1.03	5089	52.1	241	0.705092	0.512398	-4.68	0.000039	0.000010
R. Nufa									
6FR	1.29	8124	69.1	316	0.705190	0.512435	-3.96	0.000045	0.000010
Evate									
12FR	0.21	4015	41.5	230	0.704766	0.512399	-4.66	0.000030	0.000017

A Lower Cretaceous K-Ar age of **117 Ma** was obtained on amphibole from the Rio Mufa carbonatite, indicating contemporaneity with similar occurrences of carbonatites and other alkaline bodies of the Chilwa Province (see Wooley, 2001). Regarding Sr 87/86 initial ratios, the values presented in this study roughly between 0.703 and 0.706 (Table 1) are not dissimilar to those compiled by Kalt at al (1997) carbonatites of the East African Rift.

5. REFERENCES:

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