Long-lived Mesoproterozoic magmatic activity in Namibia – Insights to the origin and evolution of anorogenic igneous suites

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The crustal evolution of NW Namibia during the Mesoproterozoic is characterised by the repeated intrusion of large volumes of mantle-derived melts. Igneous activity started at 1.39-1.38 Ga, more than 100 Ma after the last recorded metamorphic event, with the intrusion of anorthositic rocks of the 18000 km^2 Kunene Complex. Coeval rock suites include mafic to ultramafic satellite intrusions and granitoids (1.38-1.35 Ga). The general isotopic characteristics of the anorthositic rocks (i.e. εNd: +3.0 to 0.5; $^{87}Sr/^{86}Sr$: 0.7028–0.7042; $\delta^{18}O_{SMOW}$ plagioclase: 5.6-7.5 ‰; εHf zircon: 1.0-3.5) and the associated granitoids (i.e. εNd: +2.0 to -0.4; $^{87}Sr/^{86}Sr_{(T)}$: 0.7024–0.7063; $\delta^{18}O$ feldspar: 7.2–7.9 ‰; εHf zircon: 1.0-3.5) are in excellent agreement with their development from mantle-derived magma and suggest only minor crustal contamination of the granitic melts by anatexis of the lower crust. Emplacement of the anorthositic crystal mushes in the middle to lower crust (c. 1000°C, 7.5 kbar) was followed by subsolidus re-equilibration of the plutonic body during cooling and uplift (c. 700-800°C, 6.2 kbar). The intrusion of the associated granitoids occurred at similar pressures (6.5 kbar).

Subsequently, the same area was invaded by nepheline syenite stocks (1.22-1.21 Ga) along major, deep crustal lineaments [1] and by younger carbonatite and associated nepheline syenite dykes (1.14-1.12 Ga), emplaced in upper crustal levels (3-5 kbar). A mantle source of the ferrocarbonatites is constrained by the oxygen and carbon isotope compositions of separated ankerite ($\delta^{18}O_{SMOW}$: 8.91-9.73, $\delta^{13}C_{PDB}$: -6.98 to –6.76) as well as neodymium and strontium isotope values (εNd: 0.7–1.8, $^{87}Sr/^{86}Sr$: 0.7035-0.7036).

In combination, these data povide evidence for episodic, long-lived igneous activity between 1.4 and 1.1 Ga, associated with the repeated intrusion of fractionated mantle melts. A within plate, anorogenic setting is suggested by the types of igneous suites and the lack of associated orogenic events. Following these arguments, their formation might be related to the successive breakup of a 1.8-1.5 Ga continent.

[1] Littmann et al. (2000) *Beih. z. Eur. J. Miner*. **12**, 115.

Certification of Os concentration and $^{187}Os/^{188}Os$ for Co-rich crust MCPt-1 reference material : Central Pacific Seamount Zone

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Sample and Analytical Methods

Os isotopes offer high sensitivity in dating and tracing in marine environment. A Re-Os reference material is needed to decrease systematic measurement differences between laboratories [1]. The Co-rich crust MCPt-1 collected from the central Pacific Ocean seamount zones was processed into ultra-fine particle size (~3000 mesh) [2]. The samples were proved to be homogeneous.

The sample must be heated 4h in oven at 110°C before weighing because the sample powder is hygroscopic. The isotope dilution method was used for determination of Re and Os concentrations. Carius Tube digestion was used for sample decomposition. N-TIMS (Mat-262 and Triton) and HR-ICP-MS were used for isotope ratio measurement.

Discussion of Results

Results are listed in Table 1. Certified values are the weighted averages. The confidence level of uncertainty is 95%. N is the number of data sets, n is the number of determinations for each sample, and nN is the total number of determination. The values of Re are just for reference.

Item	Certified values	uncertainty	Data sets	
			N	nN
Os ng/g	1.126	0.036	4	59
$^{187}Os/^{188}Os$	0.8790	0.0031	4	45
Re ng/g	(0.022)	(0.015)	2	42

Table 1: The certified values.

[1] Du *et al.* (2004) *Geostandards and Geoanalytical Research* **28** (1), 41-52. [2] Wang *et al.* (2007) *Geostandards and Geoanalytical Research* **27** (3), 251-257.