Activity increased with time, it is episodic and temporally & spatially associated with 'control', carbonatitic activity over time / several periods suggests lithospheric processes.

...occurred in the mid-Cretaceous (1989, 1994; Harmer, 1998), partly due to their erosion-prone nature and ongoing crustal uplift and evolution. The most notable post-Pan-African peak in southern Africa, North America, Brazil and Siberia, areas that display a 200 Ma duration in the lithospheric mantle are reflected in the overlying upper lithosphere.

Higher mean mantle Potential temperatures ...variable plate motion direction (60/30 Myr periodicity).

Recent summaries of African Plate motion spreading vectors (Müller, 1995; Goddard Space Flight Centre, VLBI Solution KB2001 of Version 01).

Rapid Kimberlitic Fluid Extraction from the Lithospheric Mantle

Introduction

Kimberlite and related rocks range in age from the Archaean (evidence for diamonds in the Witwatersrand Basin and in Ghana; phlogopite-rich lamprophyre intrusions in the Northern U.S.), to the Cretaceous (e.g. Viljoen, 1999; i.t.o diamond potential.

To clarify and summarize the sequence of events operative in southern African kimberlitic intrusion, and the times, spatially and overlap of these events.

To merge recent data on a number of apparently unrelated features, such as plate motion vectors, lithospheric mantle fabrics and preferential mantle melt accumulation within these fabrics, with a view to explaining the mechanism of unusually abundant, geologically instantaneous instantaneous Kimberlite formation in the southern Africa region during the Mesozoic.

Cretaceous Events

Increased mid-Cretaceous mantle convection ("superplumes", Laron, 1991); or related to consistent plate motion the Jurassic period; a situation similar to oceanic crust, [100]

Accelated plate motion coinciding with the arrival of the Pan-African orogenic belt.

Higher mean mantle Potential temperatures (Pθs); temperatures shallowed towards higher values and a greater degree of temperature variation compared to the Archaean cratonic root.

Stress-induced, ductile deformation of the mantle present at, amongst other settings, 200 km from the southern African margin (e.g. Viljoen, 1999; i.t.o diamond potential.

"Vertically coherent deformation" (Sliver et al., 2001) when changes in the lithospheric mantle are reflected in the overlying upper lithosphere.

Cretaceous Plate Motion

Data summarised in Summerfield (1996), in km based on data from Dhuime et al. (1991), Maguire et al. (1992), and Summerfield (1996).

Sequencing

Plate still-stands, relative plate still-stands and plate motion velocity or vector changes provide for rapidly evolving deforming stresses, which have a profound effect on mantle fabrics and preferred melt accumulation. Transmission of stresses into the upper mantle must be extremely rapid to overcome grain-scale nucleation rate ("Oswald ripening") rates, especially in the case of CO2-H2O fluidic systems.

Lithospheric Mantle Structure

Localized features of the Bushveld Complex (contains Premier kimberlite; °P thing 1989, 1999) interpreted as post-African (i.e. diamond influenced).

A MDCO (approximately NC) trending shear wave splitting (fast) polarization direction evident from a closely-spaced broadband array crossing the Kimberley area (O'Brien et al., 1995; Fouchez et al., 2001).

Parallel "control EET high", an "arctic saddle-like maximum (average width > 100 km, average magnitude > 70 km) from northeast to southwest [which] determines the EET map" (Doucette and de Wit, 1995).

The "control EET high" coincides with present-day velocity vector of the African plate (e.g. Winkler et al., 1991), N40-45E at 15-20 km/s (Summerfield, 1996).

Post-90 Ma kimberlites sampled a 200 km thick lithosphere (e.g. Viljoen, 1999; i.t.o diamond potential.

The melt pocket aspect ratio (long : short axis ratio) is highest at low melt saturation levels (ca. 10% melt) and rapidly decreases as melt saturation increases.

Melt口袋 melting rate at 100 MPa exhibited an anisotropically deformed lherzolite:melt system, deformed at strain rates (based on deformation of lherzolite:melange).

Ave'Lallemant and Carter (1970) noted a melt pocket aspect ratio of 3:1 for a melt pocket of 100 MPa.

"Vertically coherent deformation" (Sliver et al., 2001) when changes in the lithospheric mantle are reflected in the overlying upper lithosphere.

Kimberlite Emplacement Rates

"Kimberlites" are a heterogeneous assemblage of minerals that crystallize from the kimberlite magma. The minerals include olivine, pyroxene, and ilmenite, which are characteristic of the kimberlite magma. Kimberlites are typically rich in rare earth elements and are associated with the formation of diamondiferous deposits.

Kimberlite Trends?

Model

Constant plate motion direction and velocity, development of preferred oblique alignment (e.g. present Kaapvaal Craton inner zone fabrics/LPO, mantle convection parallel to or, convergence of melt pools, esp. from 160 Ms onsets (Karoo basin). Plate motion stresses to U-turn" following oblique alignment of melt pockets along the plate motions (Figure 1a). The direction of spreading (degrees from north) of the idealized plate geometry approximately 220º at 120 Ma, 140º at 120 Ma, 210º at 115 Ma, 145º at 100 Ma, 95º at 50 Ma to 150º at 60 Ma (up to c. this "oscillation" underwent a 135º-180º time-melange time-motion velocity, with an average half spreading rate of about 6 mm.yr \(^{-1}\), followed by a 90 Ma time-motion velocity of the shear spreading doubled.

Conclusion

Plate still-stands, relative plate still-stands and plate motion velocity or vector changes provide for rapidly evolving deforming stresses, which have a profound effect on mantle fabrics and preferred melt accumulation. Transmission of stresses into the upper mantle must be extremely rapid to overcome grain-scale nucleation rate ("Oswald ripening") rates, especially in the case of CO2-H2O fluidic systems.