uprise meet the deduced course of data based gradients.

The highest rate of diapir uprise coincides with the maximum of crustal extension which is however confined to a narrow zone. The extensive stress regime becomes drastically altered by induced structural changes at the crust mantle boundary imposing mass excess. This leads in case to substantial decrease of the amount of extensive stresses up to a possible change of the regime to compression. Such conditions are related to a development towards the so called fossile graben type beneath basins.

The evolution and the development of enlongated mantle diapirs is finally the only concept which accounts for an optimum number of phanomena associated with continental rifting.

G4

HIGH TEMPERATURE PERIDOTITE INTRUSIVE INTO AN EVAPORITE SEQUENCE, ZABARGAD, EGYPT.

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The island of Zabargad (St. John's) is an uplifted fragment of Red Sea lithosphere which contains upper mantle peridotites. Zabargad is famous for large (up to 10cm) faceted crystals of peridot. The island contains three peridotite bodies, the largest of which is young and associated with the ocean rift. This body was intruded at high temperatures into an evaporite sequence which underlies the Red Sea. The sediments contained marly, calcareous, argillitic and mainly evaporite units which were high temperature contact metamorphosed into dark pelitic-carbonatitic rocks and light colored clastic rocks. Hornfelsic rocks are common and contain quartz, scapolite, phlogopite, tremolitic hornblende and albite, in varying proportions. One unusal assemblage near the contact contains cordierite, enstatite (En 99.9), phlogopite and rutile; cordierite is up to 4cm, enstatite to 2cm. Cordierite cores are surrounded by indialite rims and the assemblage is one of high temperature crystallization and rapid cooling in a Mg-metasomatic environment. The peridotite is mainly fresh uniform (Fo 90-93) spinel lherzolite and harzburgite; some is plagioclase-bearing. Hornblende-bearing lherzolites are probably the result of upper mantle metasomatic processes. Peridot is found in dike-like units which consist nearly entirely of olivine with minor Ni-rich serpentine and Fe-Ni oxide. The peridot is found in open cavities and as overgrowths on large (up to 20cm) flat brown olivine crystals. Peridot is also Fo 90-93 and has abundant fluid inclusions which Clocchiatti et al. (1981) find to be remarkably hypersaline; they formed at high temperatures (750-900°). Peridot was formed by magnesian hydrothermal solutions which are to be expected in young oceanic rifts.

G5

THERMAL HISTORY OF PORPHYROCLASTS AS EVIDENCE FOR MANTLE DIAPIRISM UNDERNEATH THE WEST EIFEL (WEST GERMANY)

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Porphyroclastic mantle peridotites of the NW end of the West Eifel volcanic chain contain orthopyroxenes up to 8 x 2.5 mm in size. Clinopyroxenes and spinels have unmixed in the center of the opx. Core compositions of the opx-porphyroclasts before unmixing were obtained by microprobe analysis with a defocused beam integrating over the unmixed phases. Temperatures derived from the reconstructed core compositions are similar to the high temperature coarse grained peridotites from the center of the West Eifel, i.e. ~1100°C. For the rims of the porphyroclasts and pairs of opx-cpx neoblasts temperatures of about 800°C were calculated.

The porphyroclastic xenoliths are interpreted as constituents of the outer zone of a cooling diapir, whereas the high temperature xenoliths come from the center.

G6

COOLING RATE ESTIMATES FROM MINERAL ZONATION: RESOLVING POWER AND APPLICATIONS

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Mineral zonation observed in peridotite phases may be useful for estimating cooling rates and for inferring the tectonic histories of the sampled mantle. The basic cooling rate estimation method is to compute numerical solutions of the diffusion equation for assumed initial conditions and a range of cooling rates, and to match these curves to observed profiles. We have undertaken a modelling study to test the resolution of this method under linear and radial geometrical configurations. The geometries have been assumed to be ideal, but we have determined the effects of uncertainty in parameters such as diffusivities and initial temperature upon our cooling rate estimates. These experiments reveal the limits of the method, but also suggest the possibility of estimating parameters like the diffusivities when other variables can be estimated in some other way. The method has been applied to discrete garnets with peridotite inclusions from Colorado Plateau ultramafic diatremes. All phases are assumed initially to have been homogeneous. Geothermometry indicates they cooled to near or below 700°C before diatreme eruption. Though olivine inclusions are homogeneous, surrounding garnets are radially zoned in Fe-Mg for 50-100 micrometers. Enstatite crystals are zoned in Fe, Mg, Ca, and Al to at least 200 micrometers from enclosing garnet. We have tested the range of cooling rates, initial temperatures, diffusivities and enthalpies in the olivine-in-garnet and enstatite-in-garnet systems which are consistent with the profiles obtained by electron microprobe observations.