altered and represent diatreme-facies with considerable volatile autometasomatism. To the west in the Appalachian Plateau (E. Kentucky and S.W. Pennsylvania), fresh rock contains abundant peridotite xenoliths. Garnet lherzolites yield pressures equivalent to depths of 150 km and 160-170 km, respectively. Megacryst chemistry records near-isobaric fractionation over ~200°C (1350-1150°C). This is like the steep, inflected limbs of the Lesotho-type geotherms. Further into the Plateau, in New York State, megacrysts record a 100 km depth and 1100-1050°C. Spinel megacrysts and spinel peridotite xenoliths also represent a shallower origin. Eclogite xenoliths in the New York and Tennessee kimberlites indicate this to be a widespread component of the lower crust in the E. USA.

The occurrences in New York lie along a N-S joint pattern, that in S.W. Pennsylvania runs for 4-5 km along a NW-SE fault, transform to the prevailing structure (perhaps in a manner analogous to similar occurrences related to South-Atlantic rifting, e.g., Marsh, 1973). The ages of the southern occurrences are older than those in the North, reflecting progressive northerly rifting with time. All of the features discussed above can be explained by the prevailing tectonic regime for the Eastern United States during Early - Mid Mesozoic times.

G11

TEMPORAL AND SPATIAL PATTERNS OF ALKALI CONTINENTAL VOLCANISM: A TEST OF THE HOTSPOT CONCEPT

S.T. CROUGH

Department of Geosciences, Purdue University, West Lafayette, IN 47907

The origin of kimberlite magma is investigated by compiling the known ages and locations of kimberlites, carbonatites, and other alkali continental intrusions. Because different proposed theories of origin make somewhat different predictions concerning eruption timing and location, these data help constrain speculation. The simplest model to test is the hotspot theory which predicts that the data must be self-consistent with plate motion over a set of mutually fixed magma sources. Other testable models include the reactivated fracture hypothesis which predicts linear patterns with uniform ages and the asthenospheric shear model which predicts craton-wide volcanism at times of rapid plate movement.

The post-Paleozoic igneous record of the Atlantic-bordering continents is found to be most consistent with the fixed hotspot concept. The same absolute plate motions which explain the majority of known seamount ages on the Atlantic ocean floor by fixed hotspots also explain most of the continental intrusions, including kimberlites. The reactivated fracture hypothesis is less satisfactory because many of the volcanic lineaments have demonstrable age progressions along their length. The shear melting model seems inconsistent with the great variety of ages observed within single cratons, although the data do suggest a relative peak of volcanic activity during the Cretaceous interval of rapid seafloor spreading.

G12

MINERALOGY AND COMPOSITION OF ABYSSAL AND ALPINE-TYPE PERIDOTITES

H.J.B. DICK,

Department of Geology & Geophysics, Woods Hole Oceanographic Institution, Woods Hole Massachusetts 02543

Abyssal and alpine-type peridotites share the mineralogic and compositional features of the depleted residues of mantle melting and magma generation. Within the somewhat limited compositional spectrum of mantle peridotites, however, there are systematic differences between these different peridotite types which reflect melting in very different physical environments. Abyssal peridotite localities are characterized by very restricted mineral compositions and a relatively high abundance of modal diopside. It is apparent that melting of abyssal peridotites in general does not procede beyond the 4-phase field Ol-En-Di-Sp, and accordingly melt compositions are constrained by the four phase pseudo invarient point.

In contrast, alpine-type peridotites are frequently highly depleted compared to abyssal peridotites, and many have lower Di/En ratios. Frequently they have highly Mg, Al-poor, and Cr-rich mineral compositions lying entirely outside the range for abyssal peridotites. In addition, many alpine-type peridotites show very large local variations in degree of melting, often with large ranges of mineral compositions. It is evident that most alpine-type peridotites have melted well into the three phase field Ol-En-Sp under very different conditions than melting of abyssal peridotites.

These differences between abyssal and some alpine peridotites we attribute to hydrous remelting of abyssal peridotites in arc environments and their eventual emplacement there as ophiolite complexes. Thus many ophiolite complexes contain mantle peridotites ranging in composition from the abyssal mantle to the highly depleted residues of the generation of arc-magmas; possibly reflecting local variations in the availability of water during the last stages of melting.

G13

MAGMATIC AND TECTONIC EVENTS IN AN OCEANIC DIAPIR.

M. OHNENSTETTER

Laboratoire de Pétrologie, Univ. Nancy I, B.P. 239, 54506 Vandœuvre les Nancy.

The lherzolitic massif from Monte Maggiore, Northern Corsica, France (3x1.5 km) which belongs to an ophiolitic complex rests tectonically on a pile of thrust slabs. Structural, petrological and mineralogical studies have been engaged to determine the chronology of coupled magmatic and tectonic events during diapiric uprise of an oceanic mantle.

The oldest relict mantle, consists of layered and folded Cpx-rich peridotites evolving from Sp-free rocks to Sp-bearing ones. They have suffered limited or extensive partial fusion events, respectively initiated by pervasive injections of limited amounts of alkali-basaltic liquids or larger volumes of Ol-rich tholeiitic magma.

Circulation of alkali-rich liquids favoring the propagation of cracks have led to local enrichment of Al, Ti, Na, K, P and Zr as testified by the composition of the phases and the thermal disequilibrium. A mappable layered Pl-rich peridotite, towards the center of an ovoid lens of depleted peridotites (0.8-0.5 km) indicate fractionation of Ol-Sp-Opx-Cpx and Pl during magma ascent.

During progressive uprise of the mantle, Opx disappears as a liquidus phase in the least evolved cumulates. Dykes with straight boundaries are filled by plastically deformed gabbros. The rotation of Cpx lineation has recorded the displacement of peridotite blocks during magma injection.

A more superficial magmatic event is indicated by fresh basaltic dykes of M.O.R.B. composition.

G14
GABBRO DIKES IN COMPOSITE XENOLITHS FROM HUALALAI

A.J. IRVING
Dept. of Geological Sciences, Univ. of Washington, Seattle, WA 98195, U.S.A.

Two composite xenoliths found in the 1801 Kaupulehu alkali olivine basalt flow of Hualalai volcano, Hawaii provide evidence for crystal-liquid separation processes in basaltic magmas ascending through narrow dikes at relatively shallow depths.

Specimen 1 shows a single, sharp, planar contact between dunite and gabbro. The gabbro has an allotriomorphic-granular texture and consists of about 50% each of aluminous calcic clinopyroxene (6.0 wt.% Al_2O_3) and plagioclase (An_{61}) with a few percent of angular grains of olivine (Fo_{78}). All of these minerals, as well as the olivine (Fo_{87}) of the dunite, contain bubbles of CO_2.

Specimen 2 consists of a straight, parallel-sided olivine-bearing gabbro dike (1.5 cm wide) cutting clinopyroxenite wallrock. No compositional gradients are apparent in either lithology. CO_2 bubbles are present in all phases. The dike has an irregular distribution of clinopyroxene (7.5 wt.% Al_2O_3) and plagioclase (An_{65}), and contains polycrystalline aggregates of olivine (Fo_{79}), interpreted as clasts of subjacent dunite wallrock which were carried in and reacted with the dike magma before crystallization of clinopyroxene and plagioclase.

The simple mineralogy of the dike rocks is consistent with formation by crystal accumulation (from flowing magma). Pressures cannot be specified well, but are possibly 5 to 10 kb. The absence of typical Cr-diopside, spinel lherzolite xenoliths at Hualalai (in contrast to their relative abundance on Oahu) may imply a relatively shallow origin for the entire Hualalai suite. It is possible that the widely-studied dunites, although now possessing porphyroclastic textures, were originally formed also by crystal accumulation (from either tholeiitic or alkali basalt magmas) and are not samples of residual mantle beneath Hawaii.

G15
QUENCHED PYROXENITE XENOLITHS FROM THE MZONGWANA KIMBERLITE DIKE, TRANSKEI, SOUTHERN AFRICA

F.R. BOYD, P.H. NIXON and N.Z. BOCTOR
Geophysical Laboratory, 2801 Upton Street, NW, Washington, DC 20008

Part of a large suite of garnet pyroxenite xenoliths in the Mzongwana kimberlite dike have quench textures. Others have polygonal granoblastic or transitional textures. Bronzite, rutile, and ilmenite form acicular crystals in sprays in the quenched rocks; diopside has crystallized as chains of fine granules. In rocks with transitional textures, bronzite crystals form thin, radiating blades up to 0.5-1 cm. In granoblastic pyroxenites the bronzite and diopside have crystallized as strain-free polygons 0.2-0.5 mm in diameter and garnet grains are sieved with fine inclusions.

About a third of the Mzongwana pyroxenites contain segregations of garnets that appear to have developed during nucleation and crystallization. Amphibole (potassic kaersutite) has crystallized along the borders of garnet segregations in two pyroxenites, where it is associated with Ti-rich phlogopite and with pool-like zones of serpentine and calcite. The amphibole is anhedral in contact with garnet but has well developed crystal faces in contact with the serpentine and calcite pools.

The presence of primary garnet and amphibole suggests that these pyroxenites formed at a depth of about 100 km, substantially shallower than the depth of 150 km at which the kimberlite eruption is believed to have originated. Quench textures would be quickly eliminated by recrystallization at such depth and hence must have formed in some process that was essentially coincident with eruption. It is suggested that the Mzongwana kimberlite entrapped pyroxenite magma during eruption and that the liquid pyroxenite became quenched in contact with erupting kimberlite.

G16
THE ORIGIN OF GLASS IN ULTRAMAFIC XENOLITHS

A.J. IRVING and E.A. MATHEZ
Dept. of Geol. Sciences, Univ. of Washington, Seattle, WA 98195

Glass is a ubiquitous minor phase in high pressure xenoliths in alkalic basalts. We selected 3 samples for detailed microprobe investigation. A dunite from Hualalai contains glasses of both andesitic (anal. A) and anorthositic (anal. D) composition. The former typically coexists with chromite, sulfide and CO_2-rich fluid as inclusions (up to 50 μm) in olivine. The 4% sum deficiency is interpreted as H_2O. The anorthositic glass occurs as sinuous veinlets (up to 30 μm wide) within or cross-cutting olivine and chromite. A Canary Is. spinel lherzolite also contains andesitic glass in veinlets (anals. B,C); minor quench Ca-poor pyroxene is present. These glasses are also apparently hydrous, and have higher Ca, Mg and total Fe but lower K, Ti and P than the andesitic glass from Hualalai. In a spinel lherzolite from Mt. Leura, Victoria vesicular glass (anal. E) occurs with phlogopite in a vein.

We believe that the andesitic glasses found in these and other spinel lherzolites are produced largely by decompression during ascent as incongruent "flash" melts of low melting minerals. The anorthositic glass in the dunite may represent original intercumulus plagioclase. The andesitic glass in this sample may have originated as trapped melt+vapor±chromite±sulfide inclusions similar to those observed in submarine basalts; the present glass composition may result from subsequent crystallization of olivine and possible admixture with solute originally dissolved in the high pressure fluid phase.

Representative glass compositions

	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	SUM
A.	63.1	0.96	20.4	2.3	0.0	0.8	4.2	1.3	2.5	0.23	95.79
B.	61.4	0.02	18.8	3.3	0.0	2.7	8.0	1.0	0.39	0.0	95.61
C.	57.7	0.02	18.2	4.1	0.0	4.1	11.3	2.4	0.45	0.0	98.27
D.	51.6	0.16	29.5	1.0	0.0	0.40	13.6	3.7	0.23	0.0	100.19
E.	59.1	3.5	18.4	3.0	0.0	2.1	4.5	2.2	5.6	0.45	98.85