H16

LOWER CRUSTAL NODULES FROM THE CAMP CREEK LATITE, CAREFREE, ARIZONA

S. ESPERANCA, and John R. HOLLOWAY
Department of Geology, Arizona State University, Tempe, Arizona 85287

A suite of lower crustal mafic to ultramafic nodules collected from the Camp Creek locality (16 km ENE OF Carefree, Arizona) is comprised predominantly of eclogites (Jd/Ts>.8), garnet clinopyroxenites (Jd/Ts<.8), garnetites, and amphibolites. These nodules occur in a potassic latite (6.5%K_2O) which contains phenocrysts of biotite (Mg/Mg+Fe=.6) and clinopyroxene ($Ca_{47}Mg_{41}Fe_{12}$) as well as minor xenocrysts of plagioclase, orthoclase and quartz in fine-grained groundmass of plagioclase, clinopyroxene and oxides. Arculus and Smith (1979) and Schulze and Helmstaedt (1979) described a suite of nodules in a latite from Chino Valley (130 km NNW of Camp Creek) which is strikingly similar to the Camp Creek one (Table 1). However, the latite host at Camp Creek is slightly richer in SiO_2 and K_2O but poorer in CaO than the Chino Valley latite, possibly reflecting different degrees of contamination with the Precambrian basement.

TABLE 1: COMPARISON OF MAJOR ELEMENT COMPOSITION OF LATITES FROM CAMP CREEK AND CHINO VALLEY (in weight %)†

	Camp Creek*	Chino Valley**
SiO_2	63.07	62.81
TiO_2	0.92	0.94
Al_2O_3	15.20	13.47
Fe_2O_3***	5.39	5.29
MnO	0.06	0.06
MgO	3.15	4.98
CaO	3.62	4.61
Na_2O	2.27	1.66
K_2O	6.61	5.34
P_2O_5	0.36	0.30
	99.41	99.46

† Analyses recalculated loss-free.
* XRF analysis by Dr. A. Yeats, Chemistry Dept. Arizona State University.
** XRF analysis from Schulze and Helmstaedt, 1979.
*** Total iron as Fe_2O_3.

The dominant nodule types at Camp Creek are garnet clinopyroxenite (some with > 50% modal garnet) and Type B eclogites (Coleman et al., 1965). Their mineralogy consists of varying amounts of garnet ($Py_{50-30}Alm_{49-28}Gross_{28-13}$) and diopsidic clinopyroxene (< 13% Jd) with minor amounts of pargasite, apatite, rutile and Fe-Ti oxides. The amphibolites make up to 30% of the suite and are predominantly composed of pargasite and pargasitic hornblende (according to Leake, 1978) with minor garnet, phlogopite, apatite, clinopyroxene, rutile, and Fe-Ti oxides. Whereas the garnet clinopyroxenite nodules are well preserved, the amphibolites contain a variety of alteration products, partial melting textures, and features along the host-nodule boundaries indicative of some reaction with the host lava. Several inclusions contain both eclogite and amphibolite in contact suggesting they coexist at depth and probably grade into one another.

Several geothermometers applied to the various mineral assemblages at P=10kbar indicate equilibration temperatures on the order of 700-900°C (Table 2). However, two samples of Type C eclogites show definite discrepancies. The first, a garnet clinopyroxenite containing 20% modal apatite, yields discordant temperature values. A second sample consisting of the assemblage garnet ($Py_{31}Alm_{45}Gr_{24}$)

TABLE 2: CALCULATED TEMPERATURES (°C) at P = 10 kb

Sample #	1	2	3	4	Mineralogy*
7549	802	790			eclogite (+am)
7514	747	716			eclogite (+ru)
7520	806	760			eclogite (+am+ru)
7502	803	868			eclogite (+ru)
7503	827	923			eclogite (+ru)
7552	809	704			garnet clinopyroxenite (+am)
7541	695	859			garnet clinopyroxenite (+ap+sp)
7529	810	857	833		amphibolite (+gt+ph)
7535			647		amphibolite (+gt+bt+pl)
7542				720±	amphibolite (+pl+ph)

1 based on Raheim and Green, 1974.
2 based on Dahl, 1980.
3 based on Ferry and Spear, 1978.
4 based on Buddington and Lindsley, 1964.
* Abbreviations: am = amphibole; ru = rutile; ap = apatite; sp = sphene; gt = garnet; ph = phlogopite; bt = biotite; pl = plagioclase.
± calculated $fO_2 = 10^{-15}$ atm.

-plagioclase (An_{51}) -clinopyroxene suggests a maximum equilibration pressure of 8±1.6kbar (assuming a_{SiO_2}=1) based on an experimental geobarometer by Newton and Perkins (1982). These pressure and temperature estimates agree with the equilibration conditions obtained for the eclogite and amphibolite nodules of Chino Valley and suggest high geothermal gradients under these areas. However, the Camp Creek suite apparently does not contain samples of the higher P, T assemblages of websterite and orthopyroxenite found in Chino Valley. The larger variety of nodule types of the latter could be a function of the larger areal extent of this locality compared to the Camp Creek area.

The similarity in the chemistry and mineralogy of the nodules and host rocks from both Camp Creek and Chino Valley localities suggest: (1) that these nodules are representative samples of the lower crust under these areas, and (2) that the latite hosts might have had a common petrogenetic history, possibly related to the period of potassic volcanism which affected the western edge of the Colorado Plateau during the Oligocene.

REFERENCES

Arculus, R. J., and D. Smith, 1979: In: The Mantle Sample: Inclusions in Kimberlites and other Volcanics (F. R. Boyd and H. O. A. Meyer, editors), AGU, Washington.
Coleman, R. G., D. E. Lee, L. B. Beatty, and W. W. Brannock, 1965: Bull. Geol. Soc. Amer. 76, 483-508.
Dahl, P. S., 1980: Amer. Miner. 65, 854-866.
Ferry, J. M., and F. S. Spear, 1978: Contr. Miner. Petrol. 66, 113-117, 1978.
Leake, B. E., 1978: Am. Mineral 63, 1023-1052.
Newton, R. C., and D. Perkins III, 1982: Am. Mineral, 203-222.
Raheim, A., and D. H. Green, 1974: Contr. Miner. Petrol. 48, 179-203, 1974.
Schulze, D. J., and H. Helmstaedt, 1979: In: The Mantle Sample: Inclusions in Kimberlites and other Volcanics (F. R. Boyd and H. O. A. Meyer, editors), AGU, Washington.