CHAPTER II

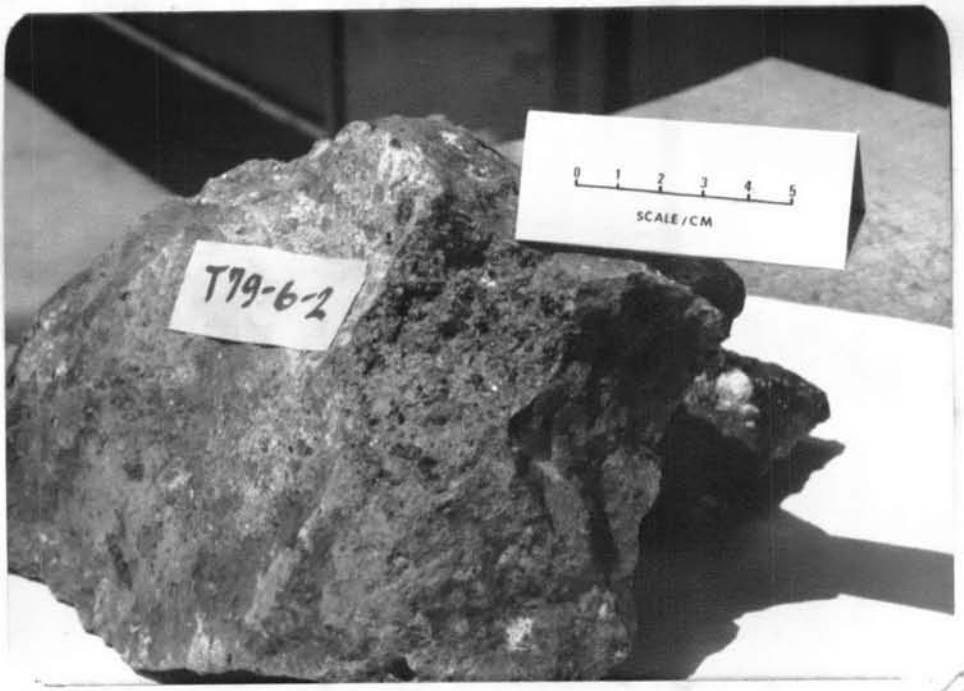
PETROGRAPHY

Megascopically, the Bo-Phloi Basalt is dark, dense, fine-grained and porphyritic rock (Figure 4). Phenocrysts are of two generations. Microphenocrysts and phenocrysts of dark greenish to black pyroxene and olive-green olivine are most commonly observed, and megacrysts as large as 1 x 3 sq. cm to 3 x 4 sq. cm of pyroxene, glassy sanidine and black spinel are commonly found. These megacrysts are also found scattering in reddish brown residual basaltic soil which mantles over the area. Ultramafic nodules of predominantly olivine and greenish pyroxene composition are also widespread in the Bo-Phloi Basalt. Commonly, they vary in sizes from 1 cm to 6 cm in diameter (Figure 5). However, nodules of the larger size are sometimes observed. Amygdales filled with earthy-white secondary zeolitic minerals as large as 1.5 cm in dimension are also found. Xenoliths of granite-gneiss of varying sizes and may be as large as 20 x 25 sq. cm. are not uncommon, especially in the area of outcrop number 2,3,4 and 5.

Microscopically, the Bo-Phloi Basalt is generally holocrystalline and hypocrystalline. The rock is fine-grained, porphyritic and predominantly hypidiomorphic to panidiomorphic (Figure 6). It contains large amounts of megacrysts and xenoliths of varying compositions. Zeolites are often found as amygdales. Reaction rims, coronas, resorbed

Figure 4 General apprearance of the Bo-Phloi Basalt.

(a)



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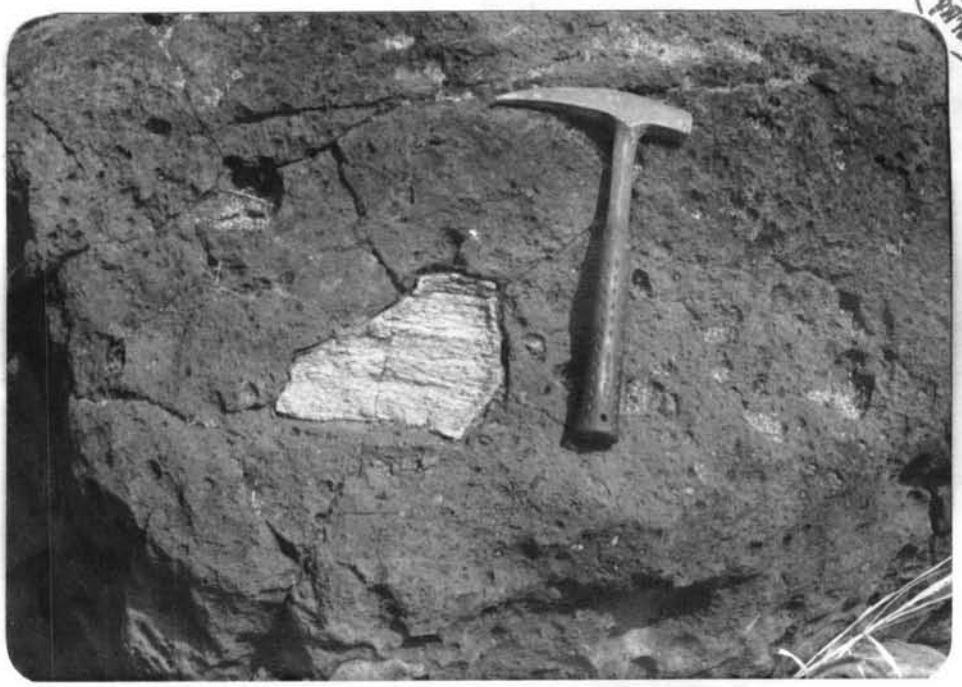
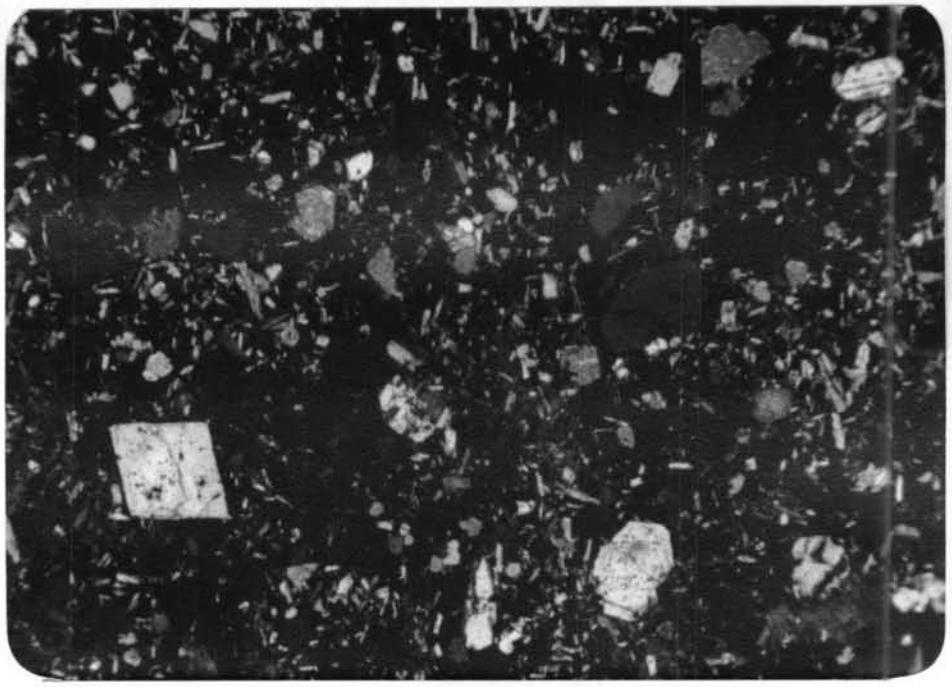


Figure 5 General appearances of peridotite nodule (a) and xenolith of gneissic rock (b) embedded in the Bo-Phloi Basalt.

(a)



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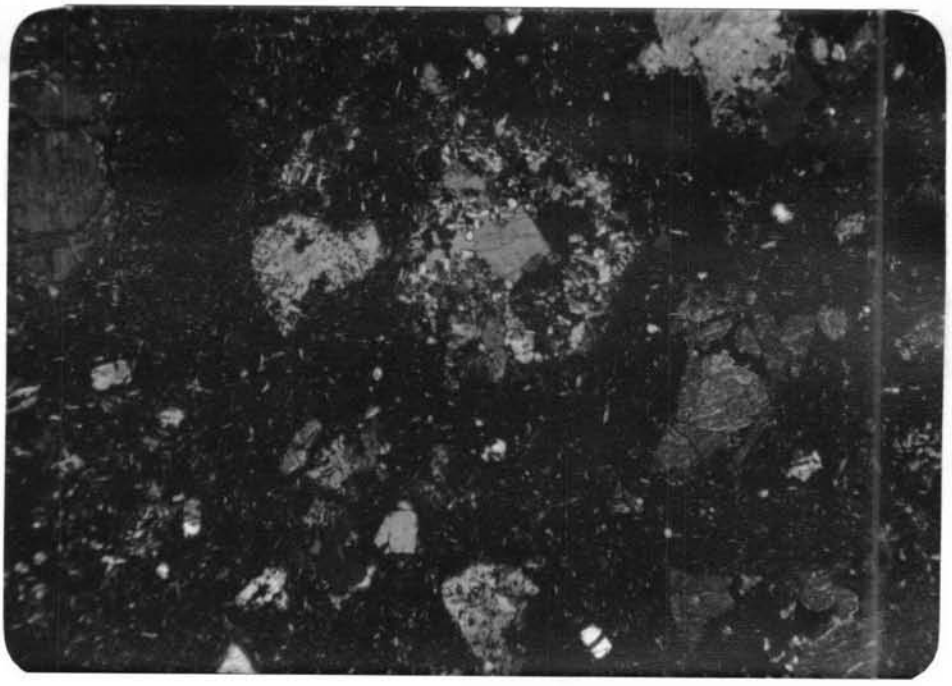


Figure 6 Photomicrographs of the Bo-Phloi Basalt showing general appearances of porphyritic texture (a), and coarser phenocrysts and inclusions (b), (cross nicols, magnification 40 x).

rims, exsolution, sieve texture and skeletal crystals are commonly occurred with either clinopyroxene or olivine phenocrysts and megacrysts.

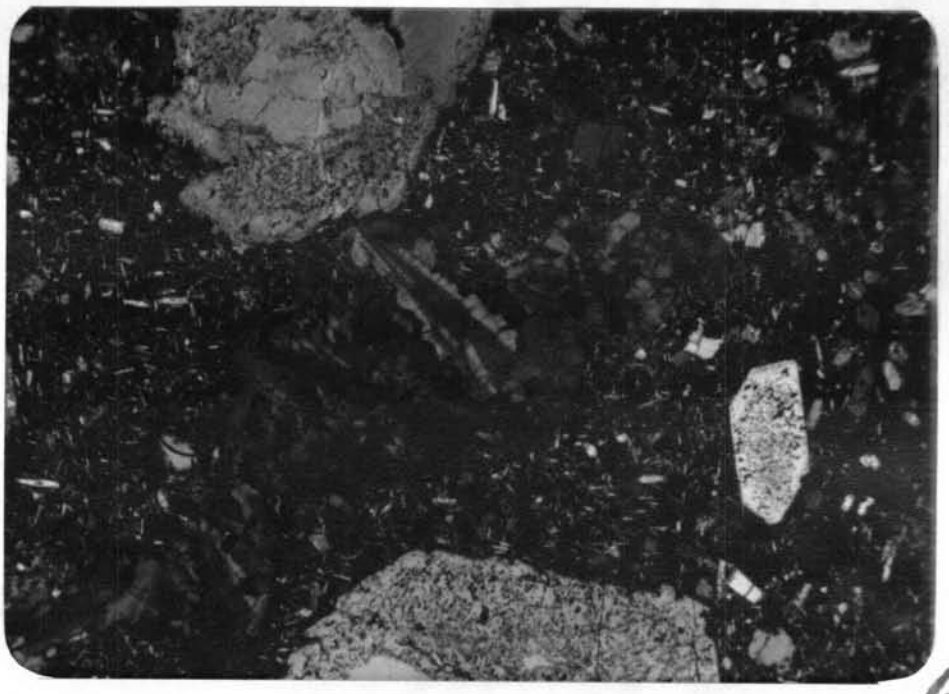
The groundmass is principally composed of clinopyroxene and plagioclase. Opaque mineral presumably magnetite, olivine, sanidine, anorthoclase, analcime and chilled glass constitute in lesser amount in the groundmass. Clinopyroxene is typical calcic augite which shows acicular and short prismatic forms. It is pale yellowish green in color. Quite oftenly, the pyroxene, especially along rims and cracks of grains is subjected to alteration and produces product of green chloritic mineral and sometimes biotite. The groundmass clinopyroxene is, normally, not larger than o.2 mm in dimension. Plagioclase is found as lath-like or as patches of subhedral forms. Only larger grains show both albite and Carlsbad twinnings. Normal zoning is also observed. An-content of this plagioclase, when it is possible to determine optically, appears to be around An 35. This indicates plagioclase composition in sodic andesine. Frequently, subhedral patches of plagioclase include many of the small grains of clinopyroxene. Both clinopyroxene and plagioclase show felty orientation. Sanidine and anorthoclase are subordinate constituents in the groundmass. Sanidine constitutes in larger amount than anorthoclase. It is usually euherral and tends to crystallize before plagioclase but after pyroxene. Optical characteristic of sanidine in the groundmass is relatively low in birefringence and possesses extremely low optical angle. The isotropic crystals of presumably analcime are also present in some rock specimens. They exibit well euhedral of dodecahedral form. They also tend to crystallize before plagioclase.

Anorthoclase, though being present in small amount, is readily identified. It is subhedral and oftenly shows Carlsbad twins.. Fine grid twin is also typical characteristic of anorthoclase. Interstitial glasses are commonly found. Scatterings are opaque minerals, mainly magnetite. The smaller grains which are not exceeding 0.08 mm, are usually idiomorphic commonly with square sections; the larger grains sometimes exceed 0.5 mm, are generally allotriomorphic. Secondary chlorite, biotite and hematite are occasionally found and calcite is rarely found.

The individual crystal grains that are larger than average grain size of the groundmass of the Bo Phloi Basalt are grouped distinctively into two populations. One of the generations is microphenocrysts (<1.5 mm) and phenocrysts (1.5-5.0 mm). Another generation is megacrysts that greater than 5.0 mm in dimension (Gutman, 1977). Phenocrysts and microphenocrysts of clinopyroxene and olivine are rather abundant where those of sanidine and plagioclase are in lesser amount.

Clinopyroxene is the most widespread phenocrysts in the Bo Phloi Basalt. Crystals are predominantly short prismatic with eight-sided and sometimes four-sided cross-sections. The smaller grains or microphenocrysts are generally well shape and clear, whereas the coarser crystals or phenocrysts frequently show sieve-texture, resorbed rims and contain inclusions (Figure 7). Some crystals are sector-zoned and some contains hourglass pattern of zonation. Polysynthitic twin is also common texture in the clinopyroxene. The larger phenocrysts are often found as glomeroporphyritic with or without olivine phenocrysts (Figure 8). Generally, the optical properties of the clinopyroxene

(a)



(b)

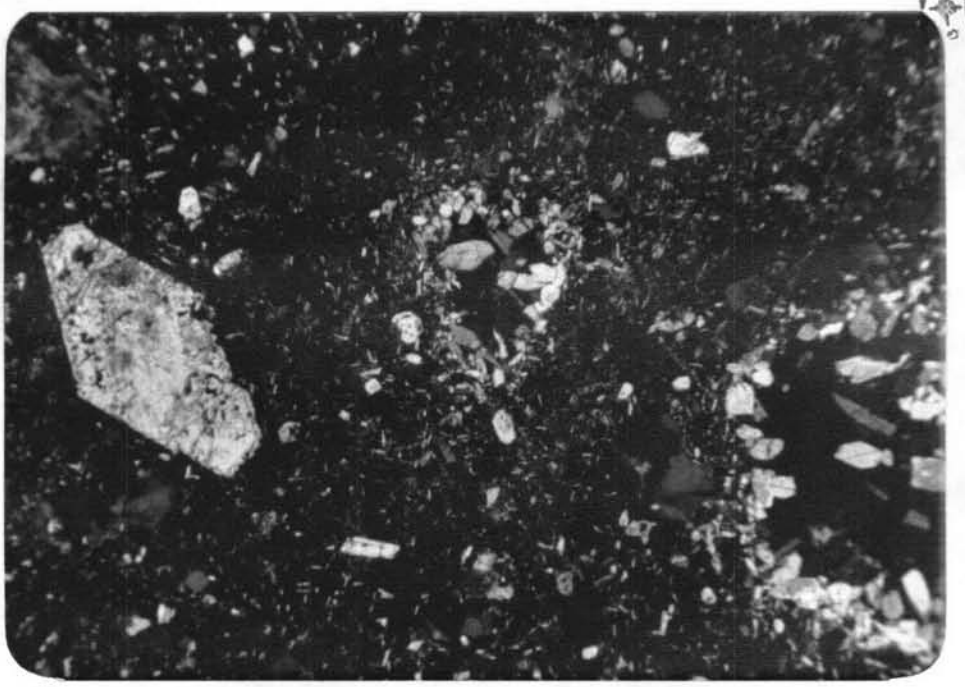


Figure 7 Photomicrographs of clinopyroxene phenocrysts showing sieve-texture and resorbed rims with zeolite filling cavities in the groundmass (a) and diabase inclusions (b), (cross nicols, magnification 40 x).

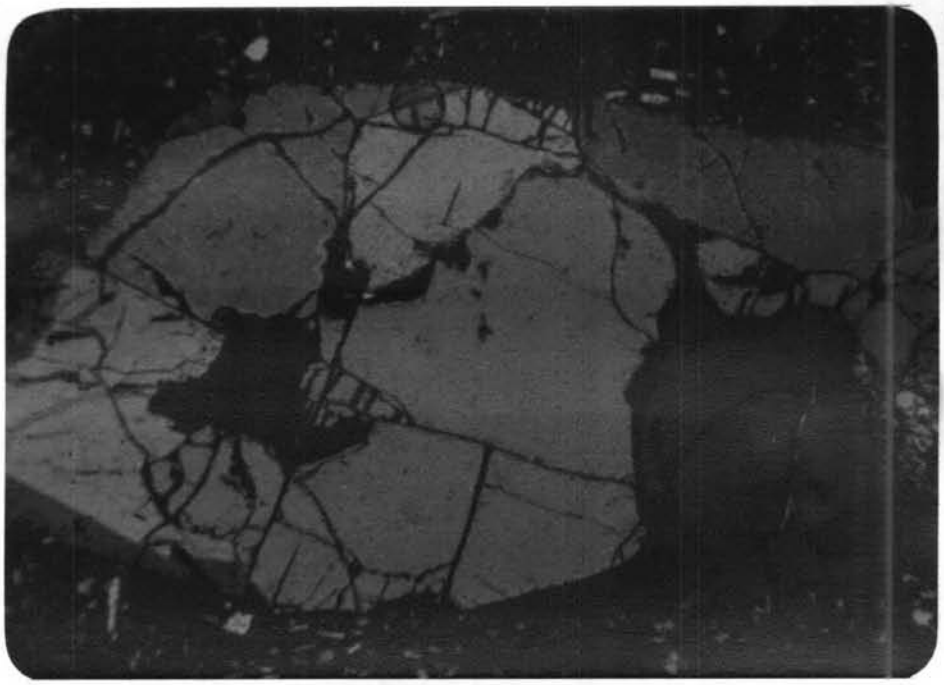


Figure 8 Photomicrograph of glomeroporphyritic texture of clinopyroxene and olivine, (cross-nicols, magnification 40 x).

phenocrysts are similar to what had already been described in the groundmass. They are presumably calcic augite with moderate optical angle.

In hand specimens, some coarser crystals or megacrysts of clinopyroxene attain as much as 10 cm in diameter. They are dark green to black, splintery, subconchoidal fracture and translucent on thin edges (Figure 9). They are identified to be calcic clinopyroxene by X-ray diffractometric method (Appendix B). Optically, they are colorless to pale greenish brown and show non-pleochroic. These calcic clinopyroxene megacrysts are the most abundant among megacrysts found in this Bo Phloi Basalt.

Olivine phenocrysts are the second abundant phenocrysts found in the Bo Phloi Basalt. They are generally colorless, fractured and occasionally twinned. They are optically negative with very large angle ($2v \simeq 90^{\circ}$). Microphenocrysts are commonly euhedral and clear crystals. The larger phenocrysts are subhedral, fractured and show skeletal crystal forms (Figure 10). Iddingsite and serpentinite are commonly found to be alteration products along cracks and rims (Figure 11). Glomeroporphyritic clots of anhedral olivine microphenocrysts are also found (Figure 12).

Olivine megacrysts are less abundant than clinopyroxene, spinel and sanidine. They are olive green, vitreous and transparent. Generally, they are less than 1.0 cm in dimension.

Sanidine phenocrysts vary in sizes and forms. The microphenocrysts of less than 0.5 mm are often found as nearly equant and clear crystals.

Figure 9 Clinopyroxene megacrysts showing conchoidal fracture and corroded surface.

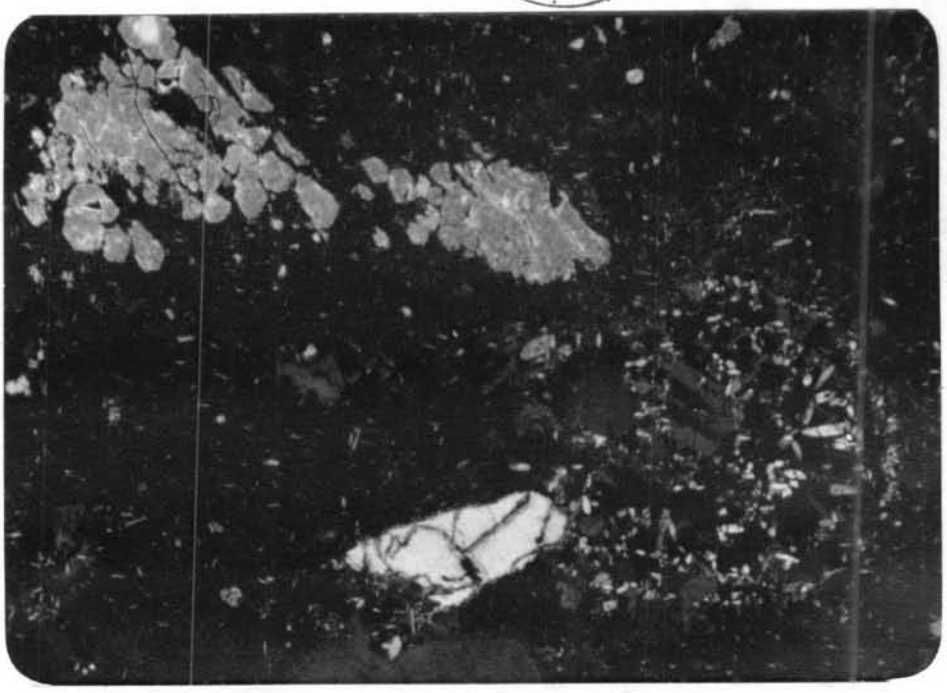


Figure 10 Photomicrograph of olivine phenocryst showing skeletal texture and accompanied by diabasic inclusion, (cross-nicols, magnification 40 x)

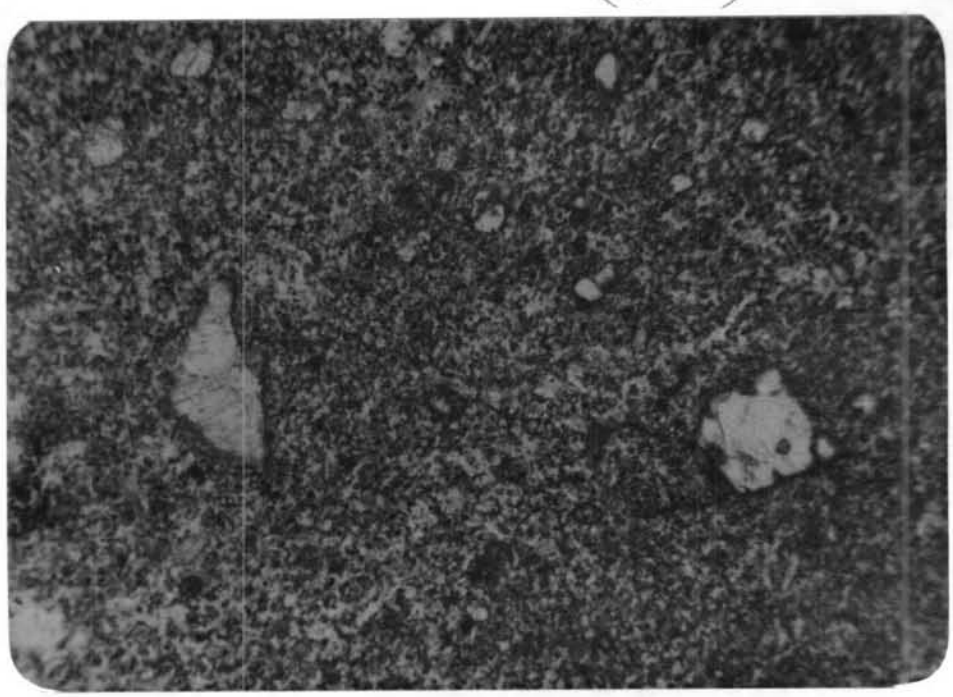


Figure 11 Photomicrograph of olivine microphenocrysts with reddish brown iddingsite pseudomorphed along resorbed rims, (plane light, magnification 40 x)

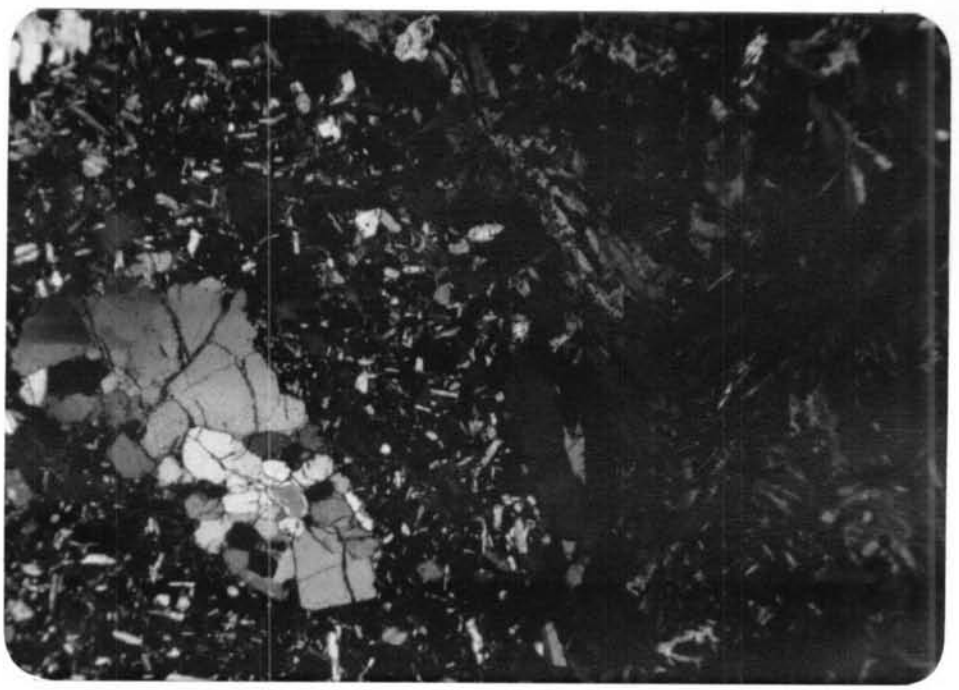


Figure 12 Photomicrograph of glomeroporhyritic anhedral olivine microphenocrysts, (cross-nicols, magnification 40 x)

The larger crystals are approximately around 0.5 mm in maximum dimension, they are subidiomorphic to allotriomorphic, often clouded and show resorbed rims (Figure 13). They generally occur as single crystal and sometimes pseudomorphed along cracks by secondary sericite. Sanidine also occurs as megacrysts. In some hand specimens these megacrysts are as large as 2-3 cm (Figure 14). They are colorless, glassy and occasionally pearly and transparent.

Plagioclase phenocrysts are rather common. They are mostly andesine in composition (An 35) and are either albite, Carlsbad or combined Carlsbad-albite twinnings. Normal zone plagioclase is occasionally observed, however, variation in composition between rim and core is rather limited. Plagioclase often occurs as cluster of interlocking anhedral crystals. Individual plagioclase phenocrysts may be surrounded or rimmed by anorthoclase, but it is rather uncommon texture.

Spinel is found as the second abundant megacrysts, occurs as corroded octahedra or fragments up to 3-4 cm across (Figure 15). They are black, vitreous, conchoidal fracture; and on the weathered surface, they show a white encrustation. Spinel is not found as single phenocryst in the Bo Phloi Basalt.

Inclusions or nodules found in the Bo Phloi Basalt are composed of varying compositions and sizes. The most widespread among inclusions is spinel peridotite or lherzolite which can be recognized megascopically. Generally it occurs as large as 5-8 cm and comprises principally of

(a)

(b)

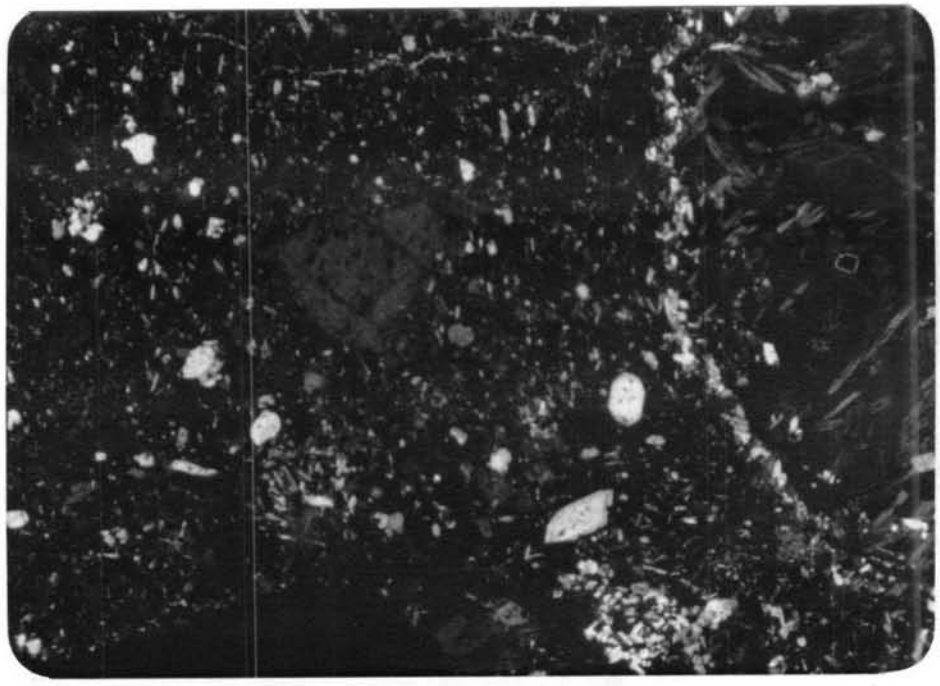


Figure 13 Photomicrographs of clear and well-shaped sanidine microphenocrysts (a) and clouded sanidine phenocryst(b) (cross-nicols, magnification 40 x).

Figure 14 A glassy, water-clear sanidine megacryst

Figure 15 Spinel megacrysts from decomposed Bo-Phloi Basalt.

olive-green olivine and bright green orthopyroxene. Microscopically, the lherzolite is equigranular and intergranular textures which contains olivine and orthopyroxene as the major constituents with minor amount of spinel and clinopyroxene (Figure 16). Other inclusions are diabase and gneiss. Diabasic inclusion in the Bo-Phloi Basalt is composed mainly of acicular or lath-shaped plagioclase and smaller well-shaped clinopyroxene. The clinopyroxene may either form intergranularly or interstitially with the plagioclase (Figure 17). Occasionally the clinopyroxene in the diabase inclusion is found to be rimmed by bright green amphibole.

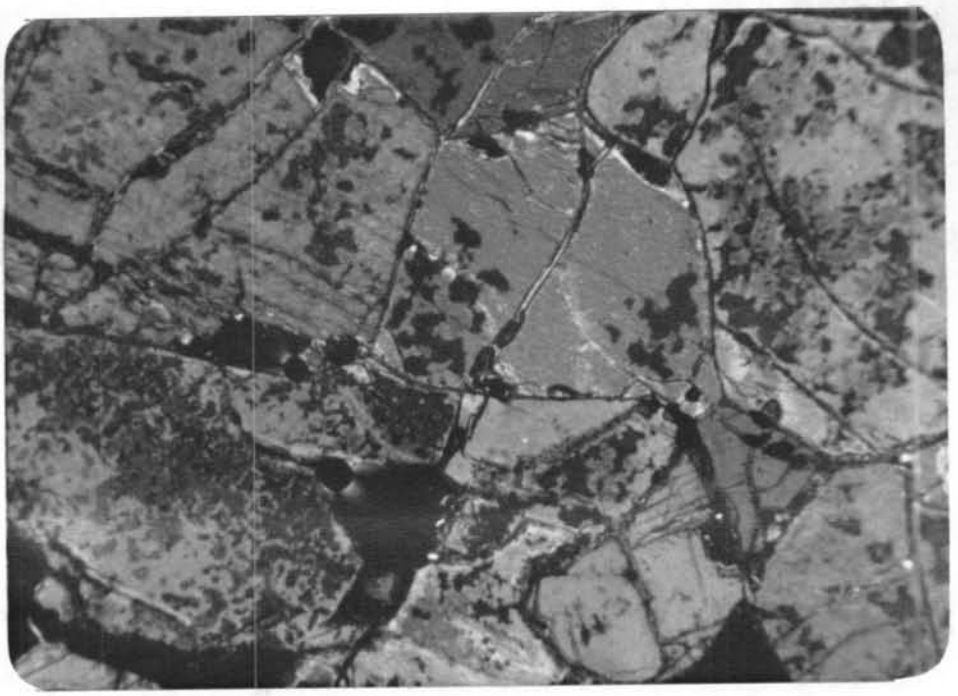


Figure 16 Photomicrograph of spinel-lherzolite inclusion, (cross-nicols, magnification 40 x)

(a)

(b)

Figure 17 Photomicrographs of diabasic inclusions (a) and (b) (cross-nicols, magnification 40 x).