# 10020

Sample 10020 is an irregular, medium dark grey, vesicular olivine basalt. This sample originally weighed 425 gm, and measured 6 X 5 X 4 cm. Sample was returned in ALSRC #1004. (Documented Sample Container).

BINOCULAR DESCRIPTION BY: Twedell DATE: 6-10-76

ROCK TYPE: Vesicular Olivine Basalt SAMPLE: 10020,16 WEIGHT: 94 gm

COLOR: Medium dark grey DIMENSIONS: 4.5 x 3.5 x 1.5 cm

SHAPE: Irregular

COHERENCE: Intergranular – Tough
Fracturing – Absent

FABRIC/TEXTURE: Isotropic/Fine grained equigranular

VARIABILITY: Homogeneous

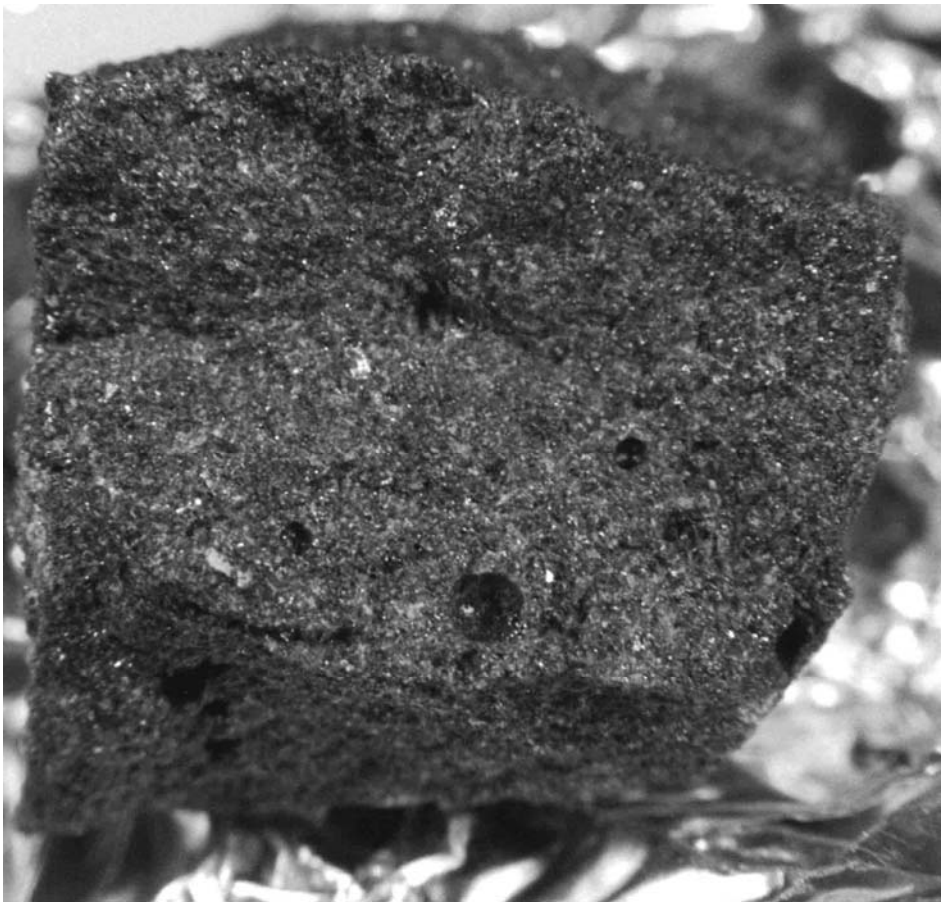
SURFACE: 3 sawed faces and one face partially sawed. Patina on all other surfaces.

ZAP PITS: Many $T_1$, none on others.

CAVITIES: Approximately 5% surface coverage up to 2mm in diameter. Cavities are crystal lined.

| COMPONENT | COLOR | % OF ROCK | SHAPE | SIZE (MM) DOM. | RANGE |
|---|---|---|---|---|---|
| Plagioclase | White | 30 | Subrounded-subangular | <.1 | <.1-.2 |
| Pyroxene | Dark | 50 | Subangular | <.1 | <.1 |
| Ilmenite | Black | 16 | Platy | <.1 | <.1-.9 |
| Olivine | Green | 4 | Subangular | <.3 | <.1-.9 |

Special Features: Sample not as fine-grained as 10049. Large olivine crystals are also present.



10020,0  Original PET Photo S-69-46481)


10020  (S-76-25459).

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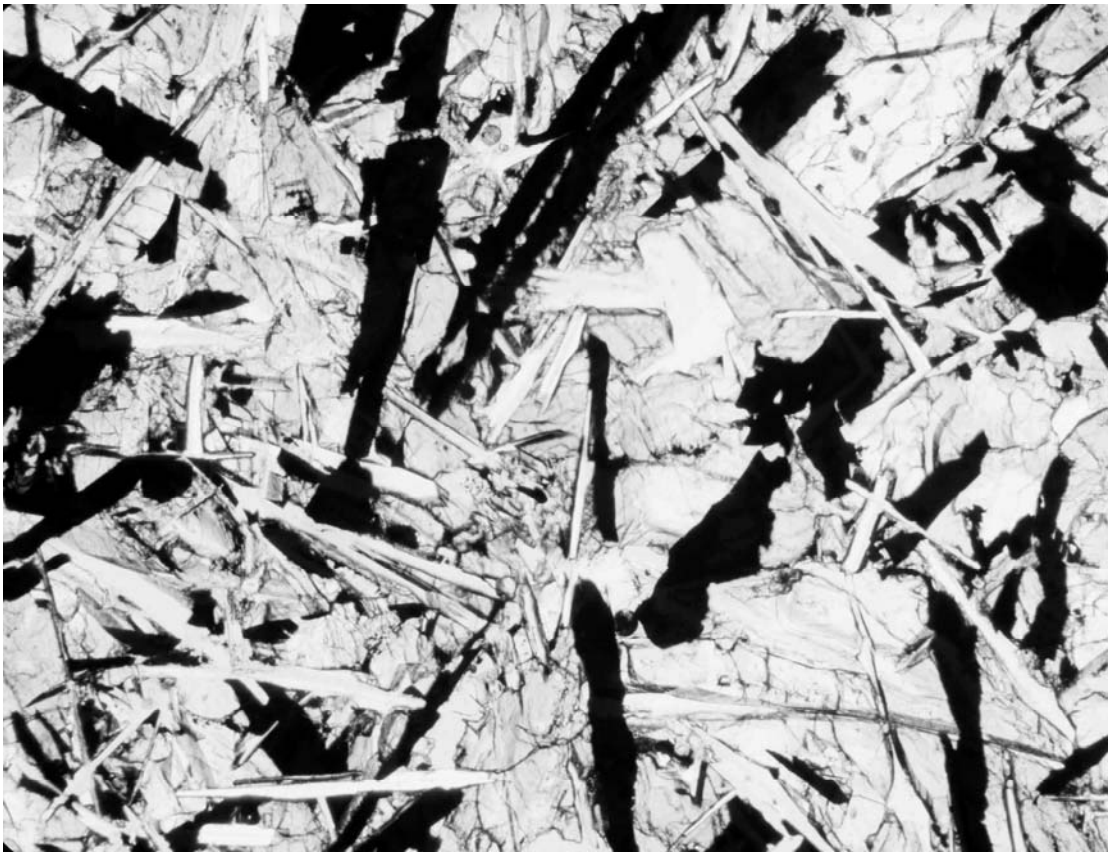

S-76-26293- SECTION: 10020,31 Width of Field: 2.22mm plane light

THIN SECTION DESCRIPTION BY: Walton DATE: 6/10/76

SUMMARY: Fine-grained vesicular ophitic basalt composed of clinopyroxene, two generations of plagioclase, two generations of ilmenite with subordinate chromian ulvospinel, troilite-iron nickel, olivine, and cristobalite. The pyroxene forms large subhedral to anhedral crystals with lath-like to anhedral ilmenite crystals in a continuous network. Interstitial to these phases are subhedral to anhedral crystals of plagioclase and cristobalite, with minor glass rich mesostasis. Some of the plagioclase crystals are slightly bent and somewhat skeletal.

| Phase | % Section | Shape | Size (mm) |
|---|---|---|---|
| Pyrox | 51 | Subhedral to anhedral | 0.2-1.0 |
| Plag | 30 | Tabular to anhedral | 0.01-0.1 |
| Opaq | 11 | Lath-like to anhedral | 0.1-0.3 |
| Oliv | 5 | Blocky, anhedral | 0.02-1.2 |
| Chr.Ulvo | 1 | Euhedral to subhedral | 0.1-0.2 |

| Phase | % Section | Shape | Size (mm) |
|---|---|---|---|
| Cris | 2 | Subhedral to anhedral | 0.05-0.1 |
| Voids | | Rounded to irregular | 0.2-0.6 |

COMMENTS:

Pyroxene – The pyroxene occurs as large pale brown to nearly colorless subhedral to anhedral crystal masses. Occasionally a pyroxene crystal is found within an olivine crystal or vice-versa. A well developed cleavage pattern is found in the more subhedral grains. Crystals of plagioclase and ilmenite occur within the pyroxene crystals and between them.

Plagioclase – Small subhedral crystals of plagioclase occur in the section associated with larger anhedral masses of plagioclase. The anhedral crystals form interstitial void fillings in the pyroxene-ilmenite network. Some bending of the subhedral crystals is present. Many of the larger crystals are somewhat skeletal in development. The smaller more euhedral crystals showed sharp twin planes while the larger interstitial crystals showed only faint to none.

Olivine – Small to large blocky anhedral crystals of olivine are scattered throughout the section. All are fresh crystals with small pyroxene rims. Some crystals contain small pyroxene crystals.

Opaques – The phases comprising the opaques are ilmenite, chromian ulvospinel, and troilite-iron nickel. Ulvospinel has been reported from this rock (Haggerty et al., 1970), but none was noted in this section.

Two generations of ilmenite are present in this section. The crystal occur as small lath-like crystal sections and also as large somewhat skeletal anhedral crystals. The larger crystals are by far more abundant.

Associated with the ilmenite are isolated euhedral to subhedral crystals of chromian ulvospinel. Approximately 10% of the total opaques in the section are chromian ulvospinel. One well defined octahedron is completely enclosed in a pyroxene crystal which is itself enclosed in a larger olivine crystal.

Small masses of troilite iron-nickel are present, but rather sparse. A few veins of iron-nickel metal are found in some of the silicate phases.

TEXTURE: Interlocking subhedral to anhedral crystals of pyroxene intergrown with two generations of ilmenite and two generations of plagioclase crystals. Interstitial to this network are masses of plagioclase, cristobalite, and mesostasis. The texture is ophitic.

Some vesicles (approximately 1%) are present in the section, but none of the crystals are seen to be growing into the void.

Selected References: Albee and Chodos (1970), Chao et al. (1970), Dence et al. (1970), Haggerty et al. (1970).

## HISTORY AND PRESENT STATUS OF SAMPLES – 10/12/76

10020 was removed from ALSRC #1004 and originally processed in the Vac Lab. It was one of the samples in F-201 at the time of the glove rupture. A small portion was sent to PCTL for PET analyses; the remainder was sawed in SPL. Samples were re-examined in SSPL.

### PRISTINE SAMPLES (ALL VAC-SPL-SSPL)

| | | |
|---|---|---|
| 15 | 0.31 gm | Fines. |
| 16 | 94.00 gm | Piece. Three saw surfaces. |
| 60 | 0.49 gm | Fines. |
| 189 | 31.59 gm | Piece with 1 saw surface. No pits or patina on rock surface. 5X3X1.5 cm. |
| 190 | 2.43 gm | Small chips and fines from ,189 & ,16. |

### RETURNED SAMPLES:

| | | |
|---|---|---|
| 3 | 6.01 gm | Sawed piece. Some pitting on one surface. Three sawed surfaces. |
| 5 | 10.54 gm | Sawed piece. Five sawed surfaces. Pitting present but rare. |
| 6 | 20.32 gm | Sawed piece. Three surfaces are sawed, one is pitted. |

## CHEMICAL ANALYSES

| Element | Number of Analyses | Mean | Units | Range |
|---|---|---|---|---|
| $SiO_2$ | 2 | 40.72 | PCT | 1.56 |
| $Al_2O_3$ | 3 | 10.57 | PCT | 1.03 |
| $TiO_2$ | 5 | 10.08 | PCT | 3.75 |
| FeO | 4 | 18.46 | PCT | 1.62 |
| MnO | 5 | 0.2615 | PCT | 0.022 |
| MgO | 2 | 8.06 | PCT | .45 |
| CaO | 3 | 11.69 | PCT | 0.91 |
| $Na_2O$ | 6 | .372 | PCT | 0.019 |
| $K_2O$ | 4 | .057 | PCT | 0.016 |
| $P_2O_5$ | 2 | .118 | PCT | .085 |
| $Cr_2O_3$ | 4 | .3514 | PCT | .0685 |
| Li | 1 | 5.00 | PPM | 0 |
| Rb | 5 | .72 | PPM | .124 |
| Be | 1 | 2.00 | PPM | 0 |
| Sr | 3 | 149.5 | PPM | 5.3 |
| Ba | 2 | 86.55 | PPM | 18.9 |
| Sc | 3 | 91.3 | PPM | 13.0 |
| V | 1 | 59.0 | PPM | 0 |
| Co | 3 | 19.66 | PPM | 3.0 |
| Cu | 2 | 5.135 | PPM | 2.87 |
| Zn | 2 | 1.69 | PPM | .81 |
| Y | 1 | 130 | PPM | 0 |
| Zr | 2 | 310 | PPM | 100 |
| Nb | 1 | 36 | PPM | 0 |
| Mo | 2 | 0.32 | PPM | 0.16 |
| Cd | 1 | 6.37 | PPB | 0 |
| Ta | 3 | 1.53 | PPM | 1.1 |
| W | 1 | 0.13 | PPM | 0 |

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| Element | Number of Analyses | Mean | Units | Range |
|---|---|---|---|---|
| Hf | 2 | 7.4 | PPM | 1.6 |
| Ir | 1 | .03 | PPB | 0 |
| La | 4 | 7.7 | PPM | 1.8 |
| Ce | 4 | 27.58 | PPM | 9.1 |
| Pr | 1 | 8.7 | PPM | 0 |
| Nd | 2 | 35.5 | PPM | 9.0 |
| Sm | 3 | 9.64 | PPM | 0.47 |
| Eu | 5 | 1.57 | PPM | 0.35 |
| Gd | 2 | 16.5 | PPM | 1.0 |
| Tb | 3 | 2.89 | PPM | 1.4 |
| Dy | 4 | 17.22 | PPM | 2.2 |
| Ho | 2 | 5.0 | PPM | 4.0 |
| Er | 2 | 9.5 | PPM | 1.0 |
| Tm | 1 | 1.2 | PPM | 0 |
| Yb | 4 | 8.19 | PPM | 3.37 |
| Lu | 4 | 1.45 | PPM | 0.09 |
| Th | 2 | 1.08 | PPM | 0.82 |
| U | 3 | 0.184 | PPM | 0.08 |
| B | 1 | 1.00 | PPM | 0 |
| Ga | 2 | 2.7 | PPM | 1.6 |
| In | 1 | 0.0146 | PPM | 0 |
| Tl | 1 | 0.33 | PPB | 0 |
| C | 1 | 100 | PPM | 0 |
| Pb | 1 | 0.36 | PPM | 0 |
| N | 1 | 40.0 | PPM | 0 |
| As | 2 | 0.045 | PPM | 0.030 |
| Bi | 1 | 0.15 | PPB | 0 |
| S | 1 | 0.17 | PCT | 0 |
| Se | 2 | 0.325 | PPM | .15 |

| Element | Number of Analyses | Mean | Units | Range |
|---|---|---|---|---|
| Te | 1 | 0.013 | PPM | 0 |
| F | 1 | 85 | PPM | 0 |
| Cl | 1 | 150 | PPM | 0 |

Analysts: Ganapathy et al., (1970); Morrison et al., (1970); Turekian & Kharkar, (1970); Maxwell et al., (1970); Kharkar and Turekian, (1971); Gast et al., (1970); Haskin (1970); Wanless (1970); Tatsumoto, (1970); Hurley & Pinson (1970); Papanastassiou (1970); Rosholt & Tatsumoto (1970).

Age References: Wanless (1970); Eberhardt (1974b); Tatsumoto, (1970).