15385 FELDSPATHIC PERIDOTITE (MARE BASALT) ST. 7 8.7 g

INTRODUCTION: 15385 (Fig. 1) is a coarse mare basalt, texturally similar to coarser-grained variants of the olivine-normative basalts but perhaps even coarser (Fig. 2). It differs in having higher MgO, a feature it shares with 15387, which is also similar to 15385 in other respects. Its argon age (3.39 ± 0.05 b.y.; Husain, 1974) is the same as that of other Apollo 15 mare basalts. It was a friable sample. It was collected as part of the rake sample from the northeast rim of Spur Crater.

Figure 1. Macroscopic view of 15385,0 as originally documented. S-71-49189

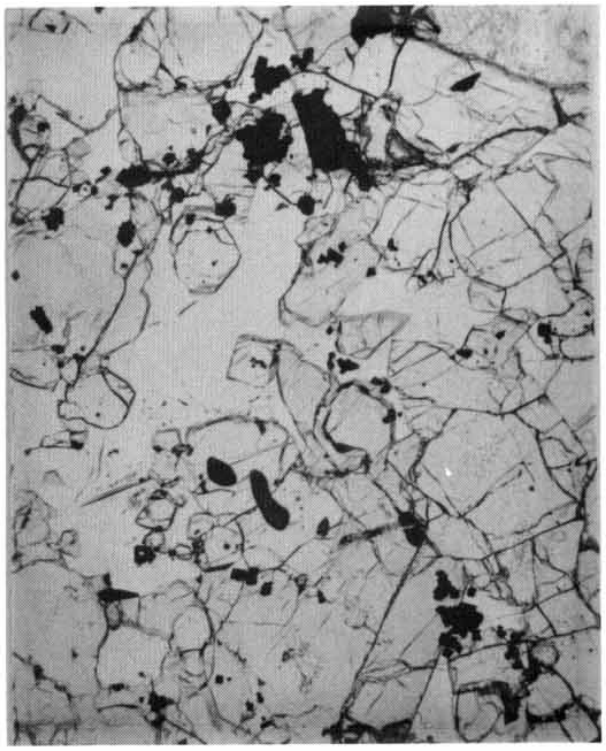
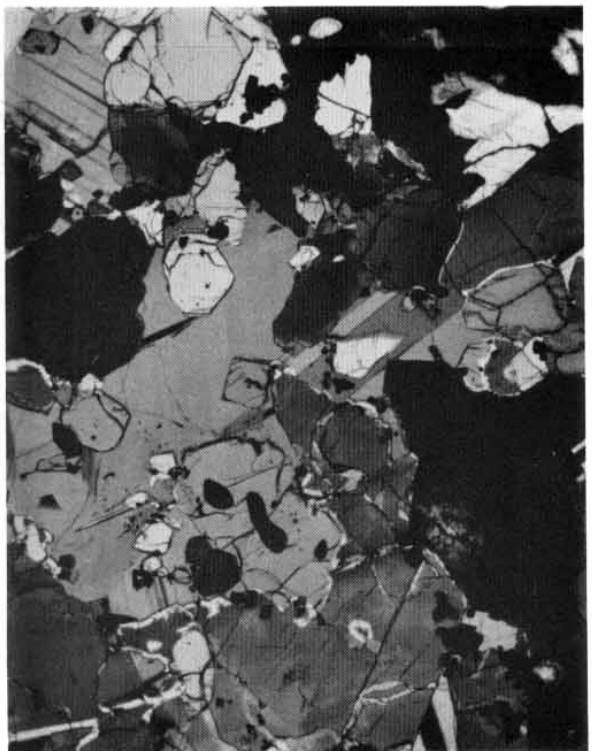


Fig. 2a

Fig. 2b



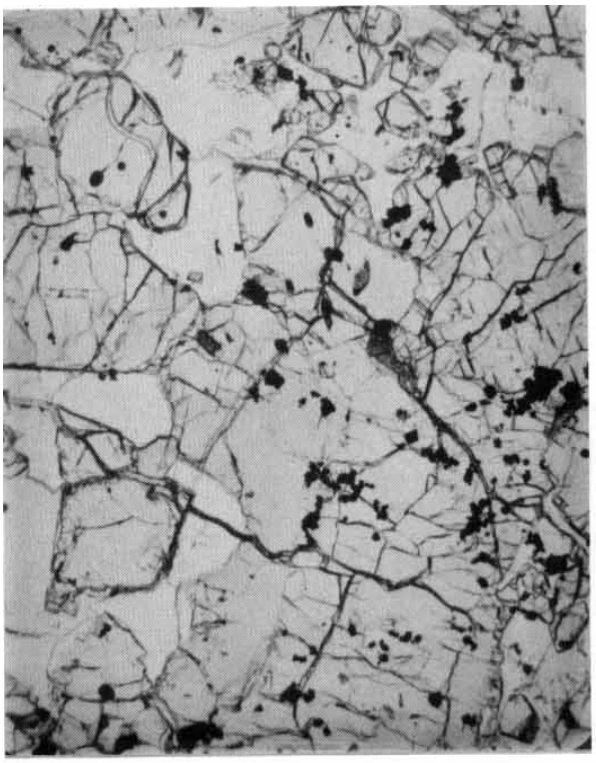


Fig. 2c

Fig. 2d

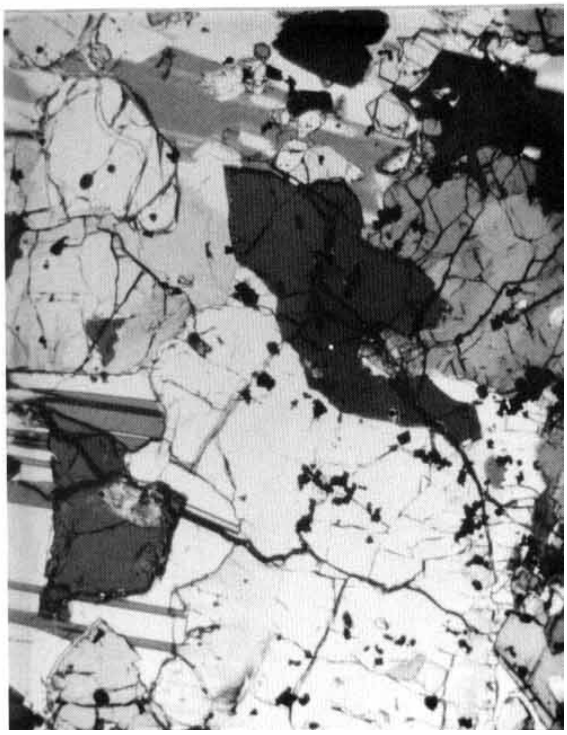


Figure 2. Photomicrographs of 15385. Widths 2 mm. (a, b) showing large anhedral pyroxenes, poikilitic plagioclases, and small euhedral olivines. The olivine just below center contains two large silicate melt inclusions. (c, d) showing large anhedral pyroxene with interior sharp zoning/overgrowth and enclosing olivine and chromite, and difference in texture of a single olivine grain in plagioclase (euhedral) and in pyroxene (embayed).

PETROLOGY: 15385 was described by Dowty et al. (1973a, b), who referred to it as feldspathic peridotite, forming a group of two with 15387. The name peridotite is somewhat of a misnomer, implying a plutonic rock, but the ranges of the mineral compositions (Fig. 3), lack of pyroxene exsolution, and high-Ca in olivine show the sample to be extrusive or of very shallow origin. Mineral analyses have been published by Dowty et al. (1973c) and Nehru et al. (1973, 1974). The mode has 42% pyroxene, 30% olivine, 24% plagioclase, 3% opaques, and 1% residual phases. Conspicuous are the large (1 to 2 mm) olivine crystals, which according to Dowty et al. (1973a) are anhedral. However, many olivines have well-developed crystal faces, especially where they are enclosed in or project into plagioclases (Figs. 2a, b). Where they are enclosed by pyroxenes, they tend to be anhedral or even embayed (Fig. 2c, d). Many contain silicate inclusions, and most are magnesian (Fo_{52-68}). Pyroxenes are large and blocky, and contain many small euhedral opaque phases. Some (Figs. 2c, d) contain sharp; boundaries with an overgrowth of more pyroxene. The pyroxenes are more magnesian than those in olivine-normative or quartz-normative Apollo 15 basalts, and few are Fe-rich (Fig. 3). Both olivine and pyroxene suggest a cumulate origin. The plagioclase is poikilitic, enclosing olivines. The ilmenite contains more MgO than other Apollo 15 mare basalts, on average (3-5%); the metal, which is in early-formed grains, has high Ni contents, more than 5%. The spinel shows the best evidence for a chromite-ulvospinel compositional gap among Apollo 15 mare basalts. Chromite is small and euhedral; ulvospinel is subhedral to anhedral. According to Dowty et al. (1973a), 15385 and 15387 could be cumulates from a melt with an Fe/(Fe+Mg) similar to ol-normative basalts; about 25% olivine plus 65% olivine-phyric basalt would roughly produce 15385. The geographic limitation to Spur Crater constrains models of origin which relates these basalts to olivine-phyric basalts (e.g., by subsurface differentiation), which are not found at Spur Crater.

CHEMISTRY: Chemical analyses are listed in Table 1 and the rare earths shown in Figure 4. Conspicuous are the high MgO and low Al_2O_3. While the high TiO_2 rare earths, and other incompatible elements demonstrate that the sample is not a mantle clino-pyroxenite, they also show that the sample is not just another Apollo 15 basalt with added olivine (with or without pigeonite) (Rhodes and Hubbard, 1973), and that, if 15385 is a cumulate, its parent had higher rare earths than other Apollo 15 basalts (however, the analysis of Ma et al. [1976], with lower rare earths and lower iron, is more in line with an origin of olivine accumulation, although those authors do not point that out). Rb is as high as quartz-normative Apollo 15 mare basalts, but Sr is even lower than olivine-normative Apollo 15 mare basalts.

GEOCHRONOLOGY AND RADIOGENIC ISOTOPES: Husain et al. (1972) and Husain (1974) performed stepwise heating on split ,3 (Fig. 5). There was little argon loss from the sample (3.5%). The ages presented are 3.32 ± 0.06 for ^{40}Ar-^{39}Ar and 3.28 b.y. for K-Ar (Husain et al., 1972), and 3.39 ± 0.05 b.y. for ^{40}Ar-^{39}Ar and 3.33 ± 0.03 b.y. for K-Ar (Husain, 1974). The age is (within error) the same as other Apollo 15 mare basalts, although Husain (1974) uses it to indicate a range of ages of Apollo 15 basalts.

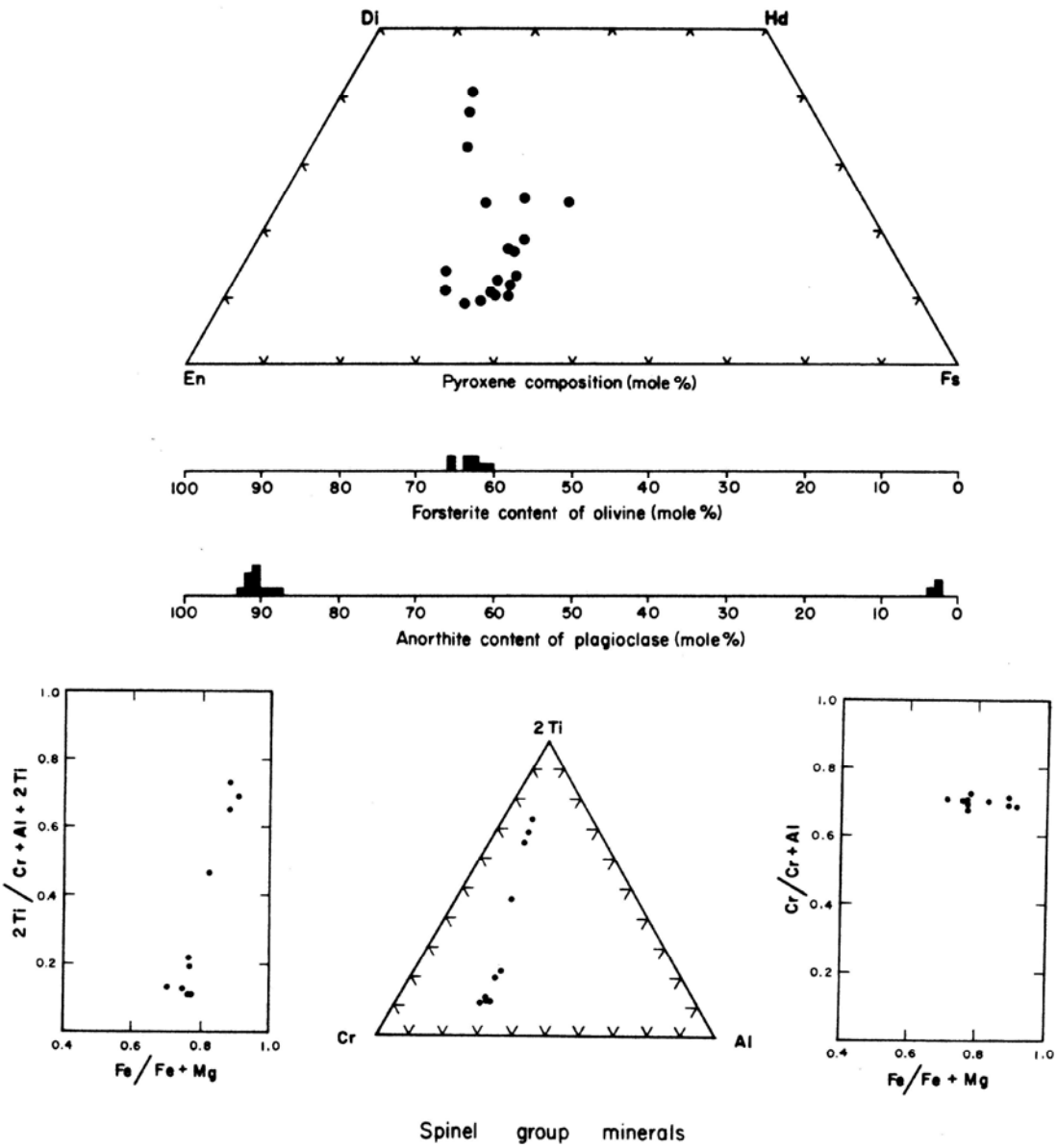


Figure 3. Composition of minerals in 15385
(Dowty et al., 1973b)

Wiesmann and Hubbard (1975) reported a bulk rock $^{87}Sr/^{86}Sr$ of 0.70134 ± 10, higher than other Apollo 15 mare basalts, but the data plot within analytical error on the same isochron as other Apollo 15 mare basalts.

<u>EXPOSURE</u>: Husain et al. (1972) and Husain et al. (1974) determined Ar exposure ages of 270 ± 14 m.y. and 298 ± 12 m.y. respectively for ,3.

TABLE 15385-1. Chemical analyses

			,2	,7	,3
Wt %	SiO2	41.4	40.72		
	TiO2	1.99	2.68	1.7	
	Al2O3	8.8	4.81	6.8	
	FeO	21.2	25.27	23.1	
	MgO	16.9	17.66	18.2	
	CaO	7.3	6.48	6.8	7.42
	Na2O	0.32	0.15	0.216	
	K2O	<0.01	0.06	0.033	0.032
	P2O5	0.03	0.08		
(ppm)	Sc			39	
	V			187	
	Cr	5550	4272	5030	
	Mn	1850	2480	1820	
	Co			64	
	Ni			138	
	Rb		1.113		
	Sr		79.0		
	Y				
	Zr		106		
	Nb				
	Hf		3.3	2.2	
	Ba		63.8	57	
	Th		0.62		
	U		0.18		
	Pb				
	La		6.96	4.0	
	Ce		18.0		
	Pr				
	Nd		13.4		
	Sm		4.51	2.6	
	Eu		0.873	0.67	
	Gd		6.08		
	Tb			0.57	
	Dy		5.89	2.3	
	Ho				
	Er		3.19		
	Tm				
	Yb		2.72	1.7	
	Lu			0.29	
	Li		5.6		
	Be				
	B				
	C				
	N				
	S		1000		
	F				
	Cl				
	Br				
	Cu				
	Zn				
(ppb)	I				
	At				
	Ga				
	Ge				
	As				
	Se				
	Mo				
	Tc				
	Ru				
	Rh				
	Pd				
	Ag				
	Cd				
	In				
	Sn				
	Sb				
	Te				
	Cs				
	Ta			1840a	
	W				
	Re				
	Os				
	Ir				
	Pt				
	Au				
	Hg				
	Tl				
	Bi				
		(1)	(2)	(3)	(4)

References for Table 15385-1

References and method:

(1) Dowty et al. (1973); defocussed beam microprobe.
(2) Rhodes and Hubbard (1973), Wiesmann and Hubbard (1975); XRF, isotope dilution/mass spec.
(3) Ma et al. (1976); INAA.
(4) Hussin et al. (1972), Hussin (1974); from Ar, irradiation, heating, mass spec.

Note:

(a) anomalously high, should be treated with caution.

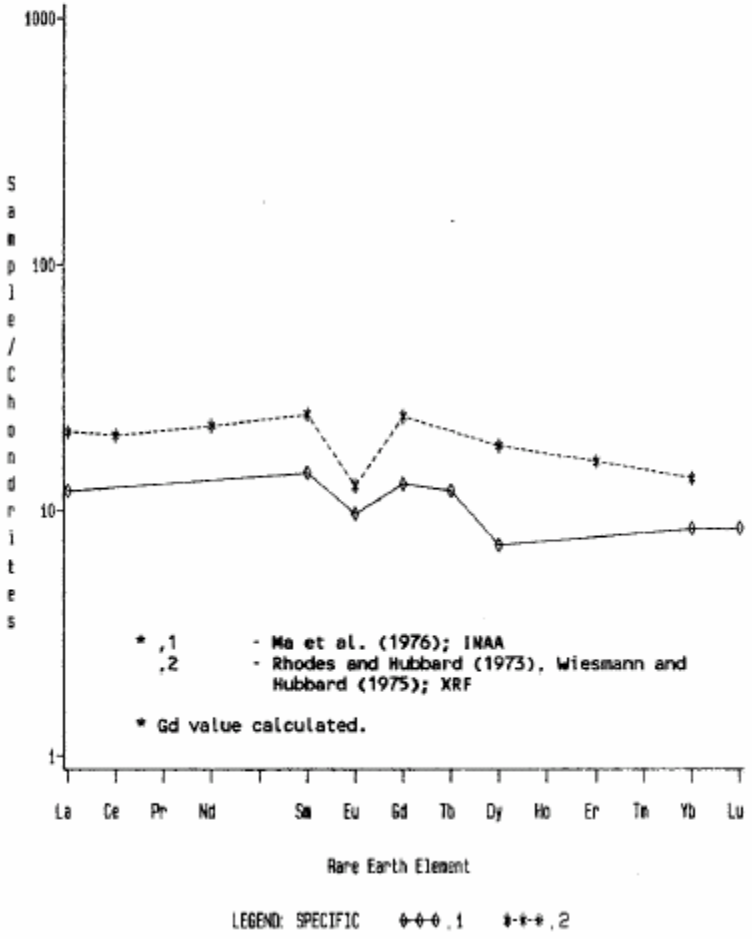


Figure 4. Rare earths in 15385.

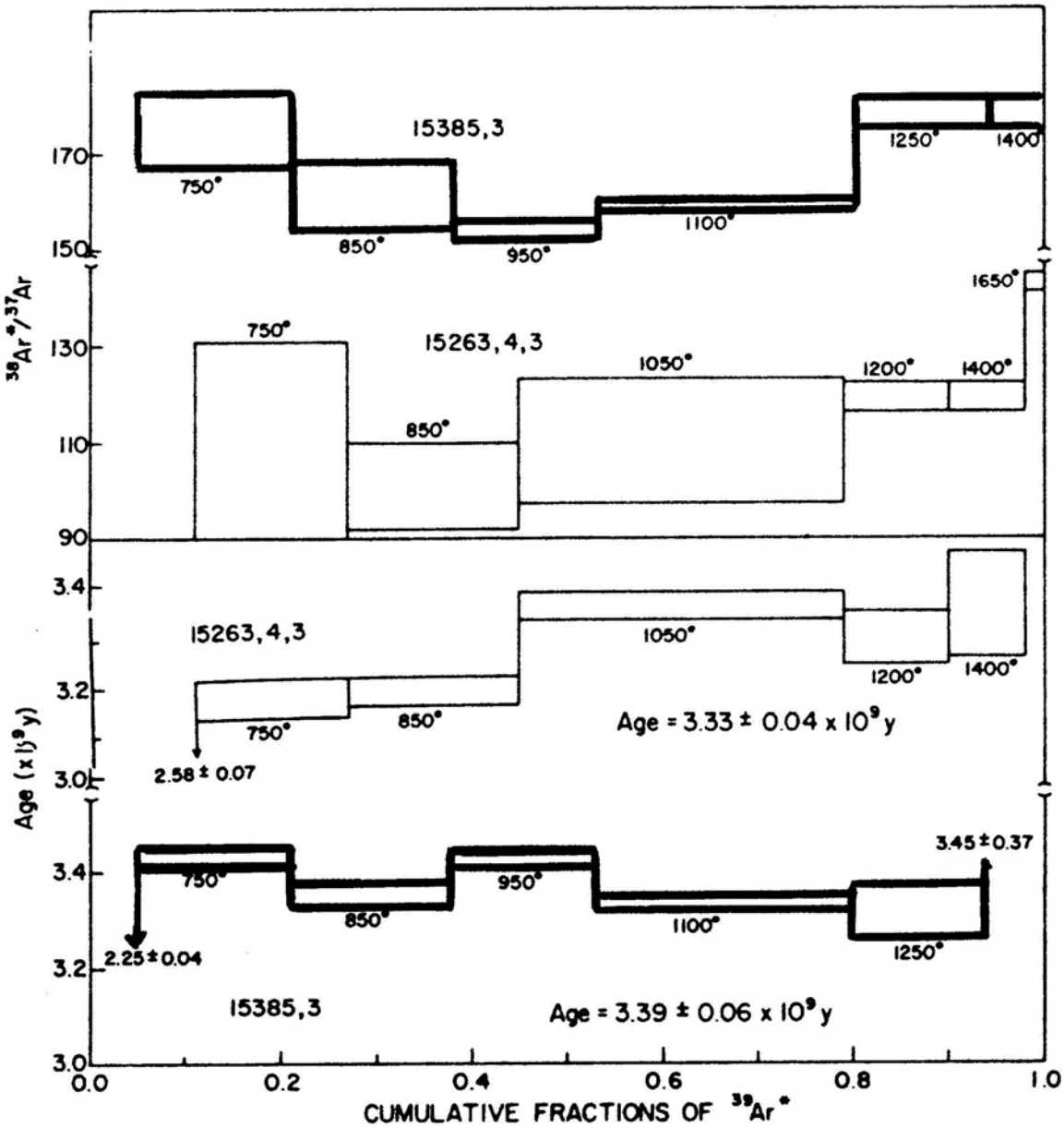


Figure 5. Argon release diagram
(Husain, 1974)

PROCESSING AND SUBDIVISIONS: The splits (,1; ,2; ,3) were chipped from ,0 for early allocations (Fig. 6), with thin sections ,9 and ,13 being produced from ,1. In 1984 two more small pieces (,17) were taken from ,0 for chemical analyses.

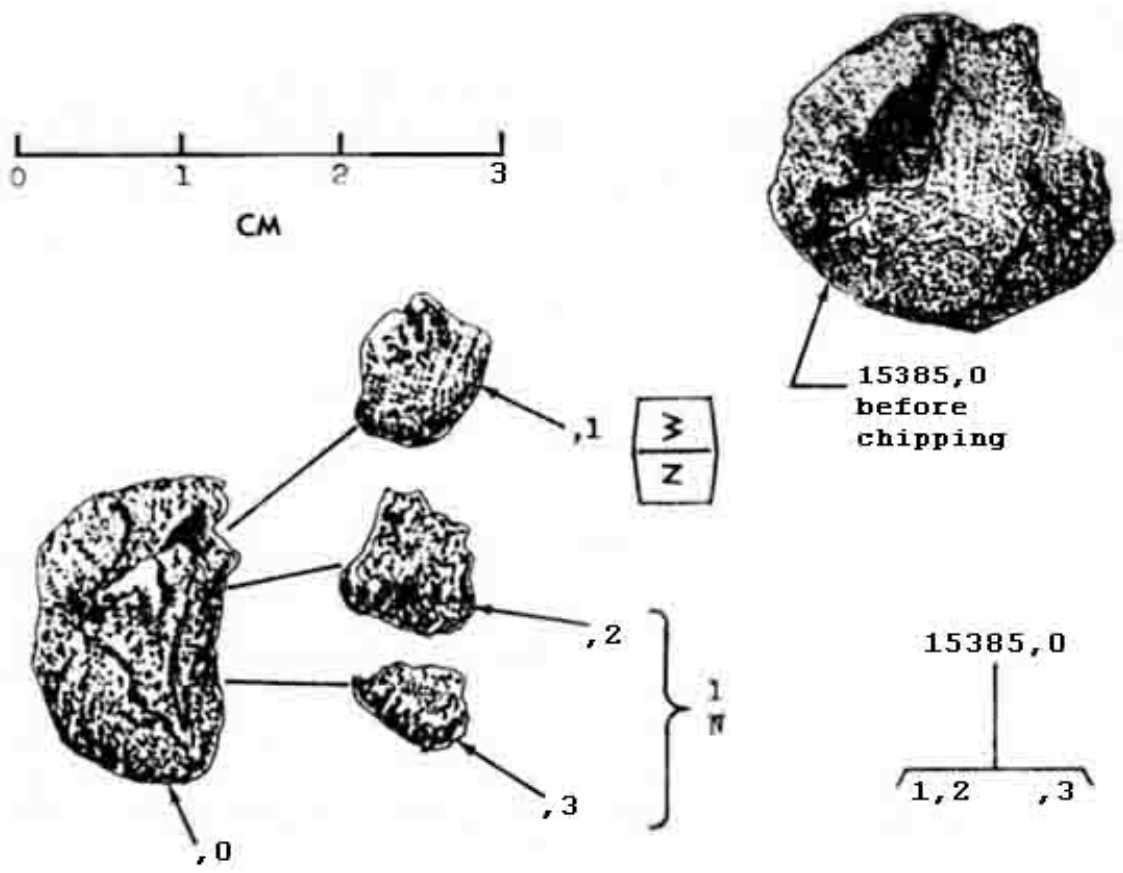


Figure 6. Chipping of 15385.