GUIDE TO THE SAMPLING OF THE FAYETTEVILLE METEORITE

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SPECIAL PUBLICATION 2

GUIDE TO THE SAMPLING OF THE FAYETTEVILLE METEORITE

BY

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INTRODUCTION

The Fayetteville meteorite, an H4 chondrite, is a gas-rich regolith breccia that fell near Fayetteville, Arkansas, in 1934. Two masses weighing 2.25 kg and 108 g were recovered by Davis Richardson, Professor of Mathematics at the University of Arkansas, who passed them on to the University Museum. In September 1983 a workshop on regolith breccias was held at the Max Planck Institut fur Chemie, Mainz. During the discussion period which ended the workshop, the desirability of further studies on the Fayetteville meteorite was stressed by several speakers. Fayetteville is one of the most gas-rich regolith breccias, yet it is relatively little-studied. Professors Johnnie Gentry (Director) and Walter Manger (Curator for Geology) of the University of Arkansas Museum gave permission for new sampling of the meteorite and a consortium was established.

The notes, tables, photographs, and diagrams in this volume are intended to help those who work on this material obtain maximum scientific return from their data. The sampling details for regolith breccias are probably more critical than for any other meteorite type, because of the possible importance of geometrical considerations, and considerable care was taken with this phase of the work.

In April 1984 a piece weighing about 1700 g was sent to the JSC curatorial facility in Houston for sawing and sampling. The sawing was done in a nitrogen band saw cabinet with a diamond edged blade. Chipping and documentation were done on a laminar flow bench in a clean room using clean tools and containers of aluminum, stainless steel, teflon, and plastic.

The piece of Fayetteville had two sawn surfaces; one was sawn half way with the half-slab removed. Figure 1 shows how the meteorite was sawn at JSC. First, the existing cut was completed yielding a small slab ,2 weighing about 65 g. Next, a 1 cm thick slab, weighing 146 g was cut and numbered ,3. The fresh side of 2, both sides of 3, and the fresh side of the butt (,1) were mapped and a number of clasts and matrix areas were identified (Figures 2 through 5).

The slab ,3 was broken up (Figure 6) and thin section chips were obtained for a few major clasts and matrix areas. These thin sections went to Robert Dodd and Ed Scott for petrologic study. Nearly a year later, after these preliminary studies were completed, more extensive allocations were made to about fifteen other scientists. Additional allocations have been made since then.

Table I lists allocations made from the original splits in Figure 6. Splits 5 through 50 came from the larger slab ,3.

Figures 7 and 8 document the locations of all splits.

Table II lists allocations including thin sections and chips which have been made from the two slabs thus far.

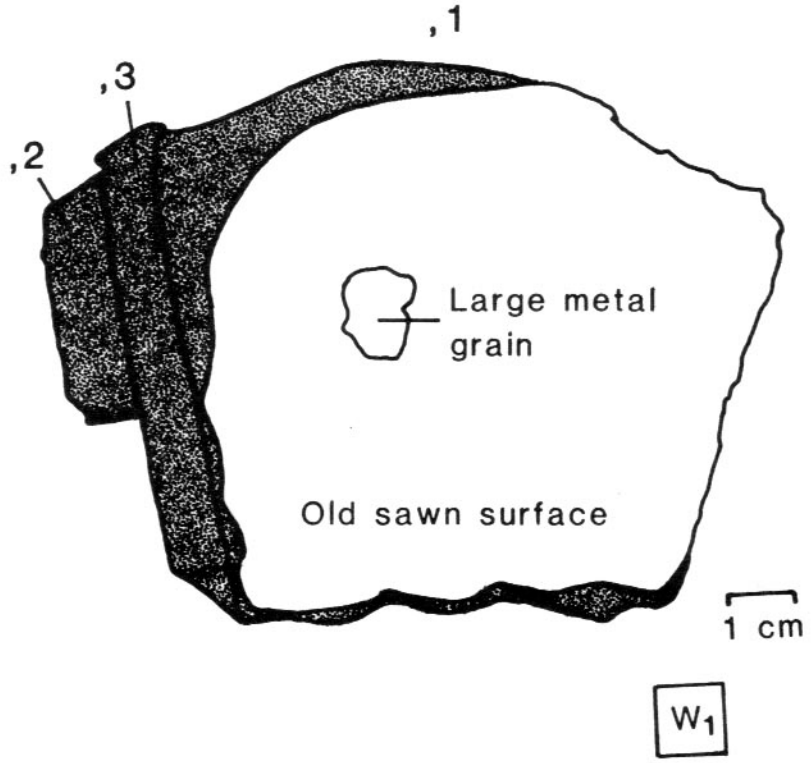


FIGURE 1. Shows the result of sawing at JSC.

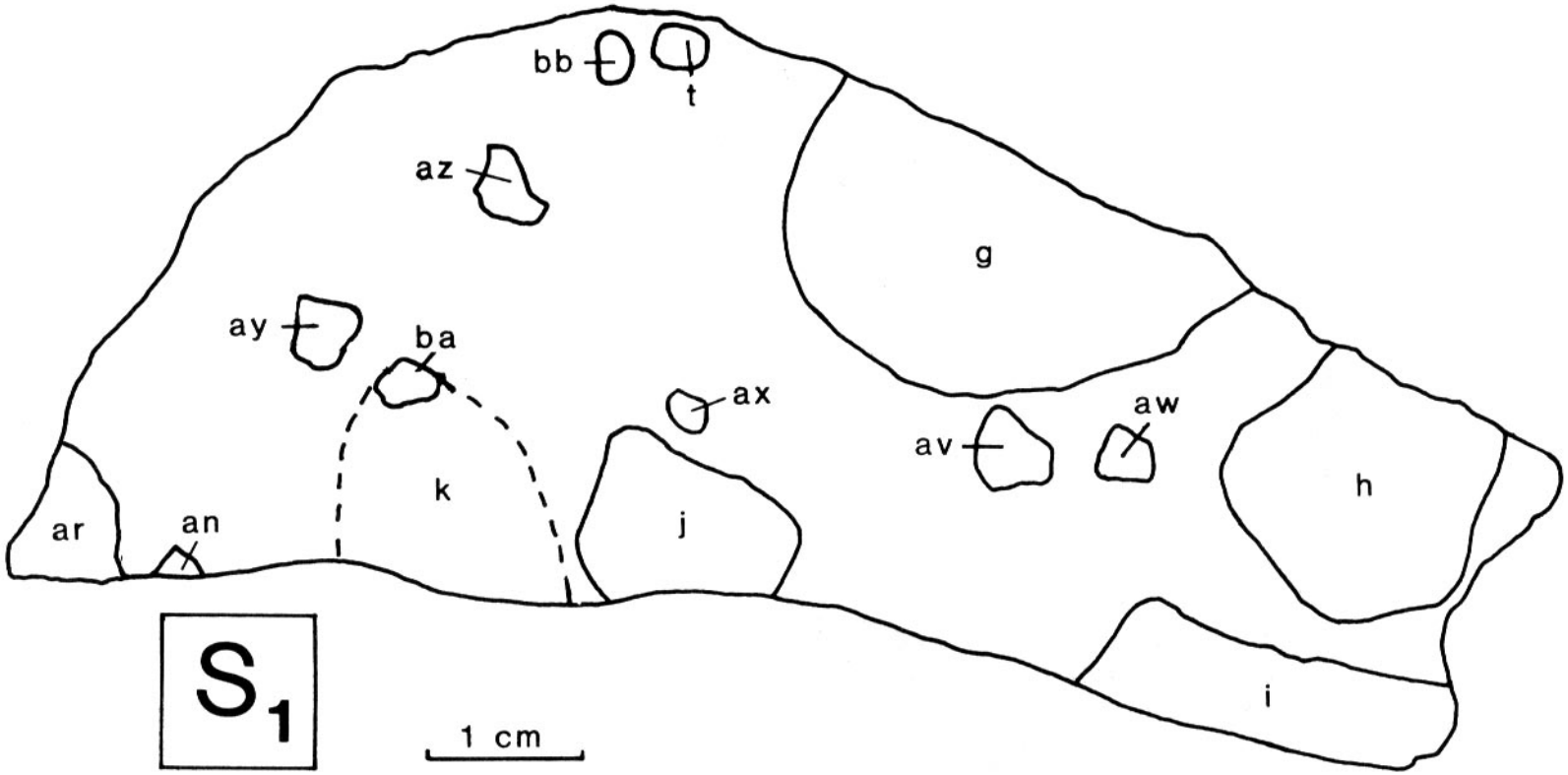


FIGURE 2. Identifies clasts on fresh cut surface of small slab ,2.

,2
Si
FAYETTEVILLE
4
5
6
8
9
10
11
12

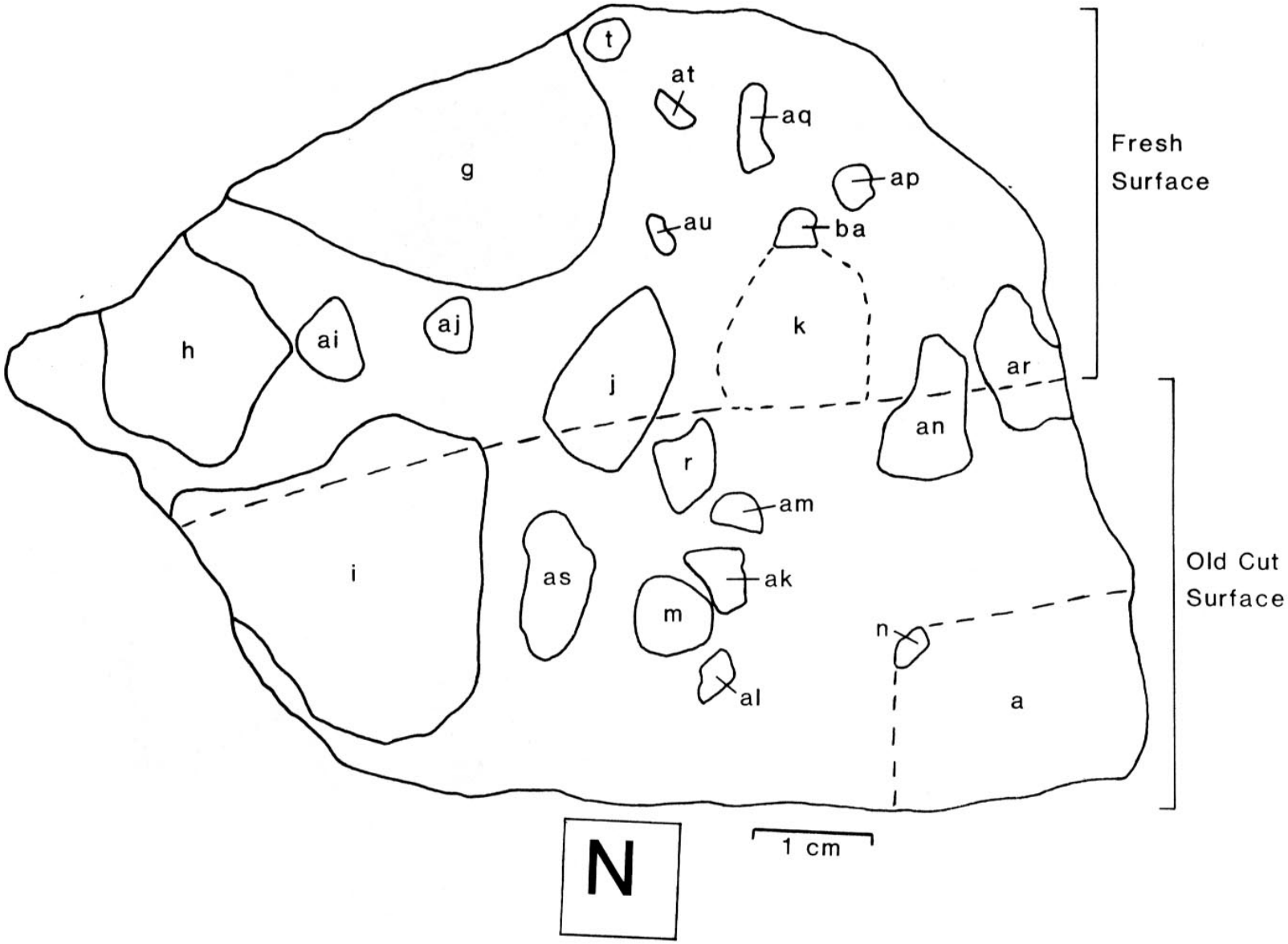


FIGURE 3. Identifies clasts on north face of large slab ,3.

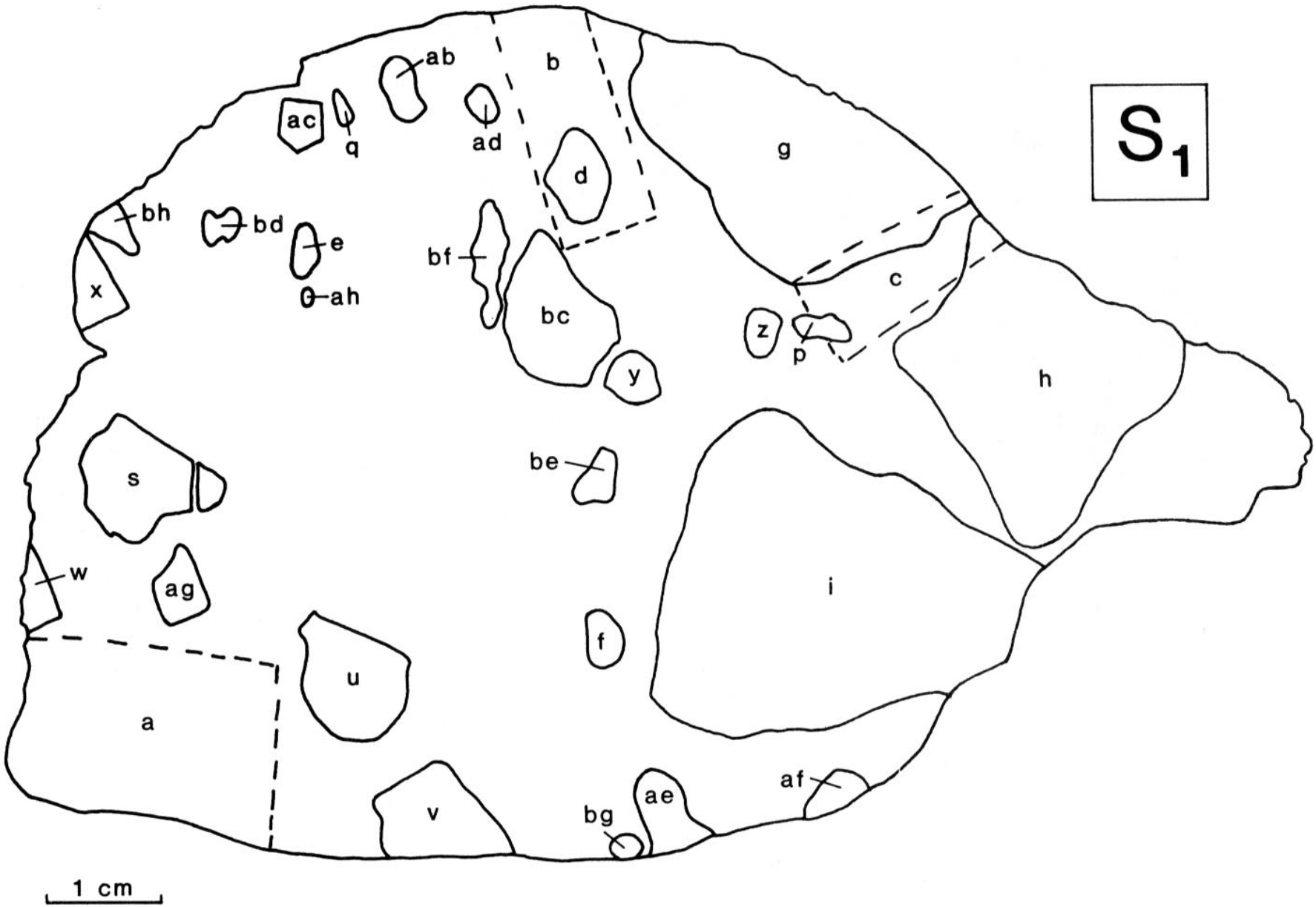
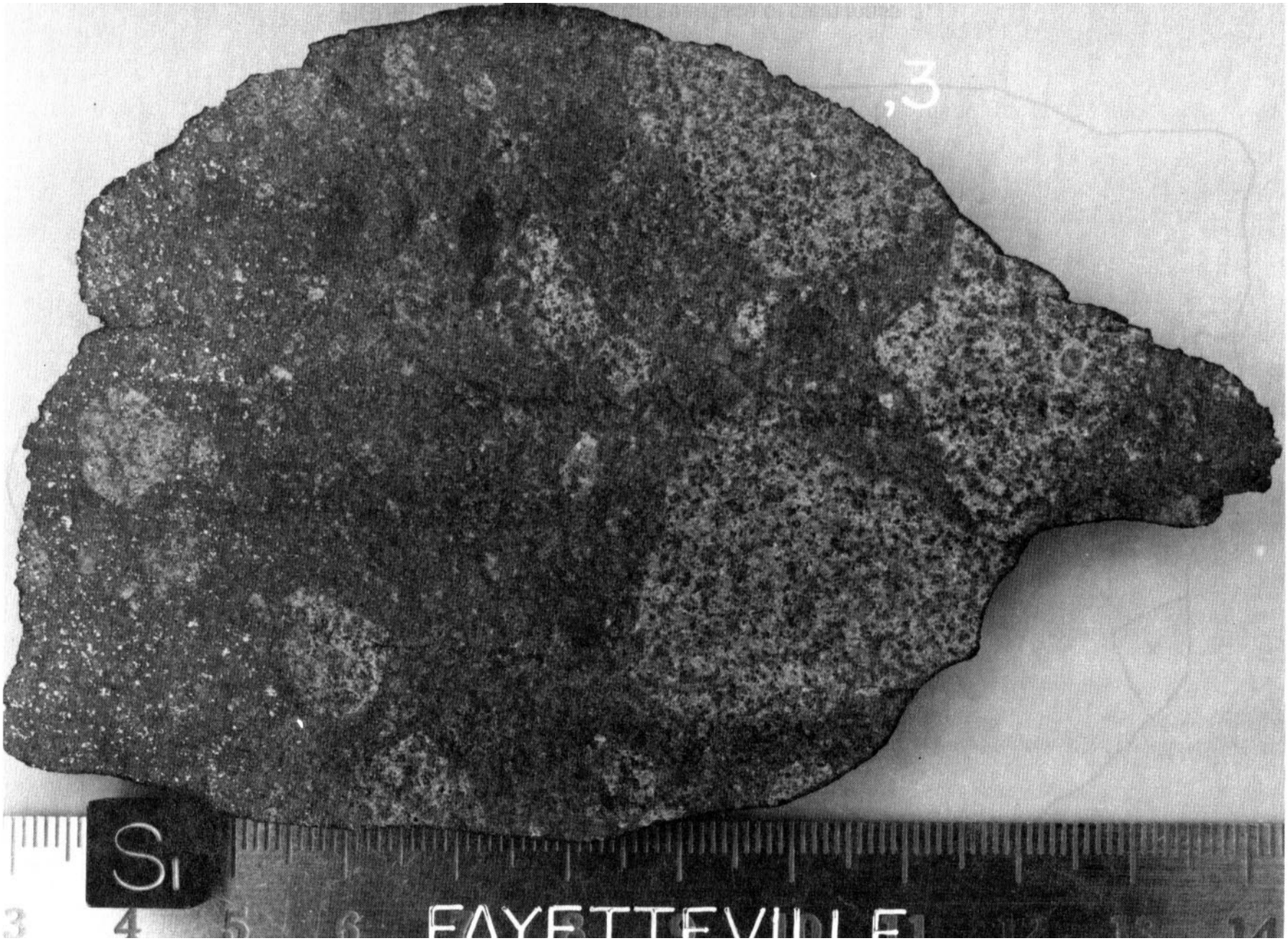


FIGURE 4. Identifies clasts on south face of large slab ,3.


,3
Si
3
4
5
6
FAYETTEVILLE

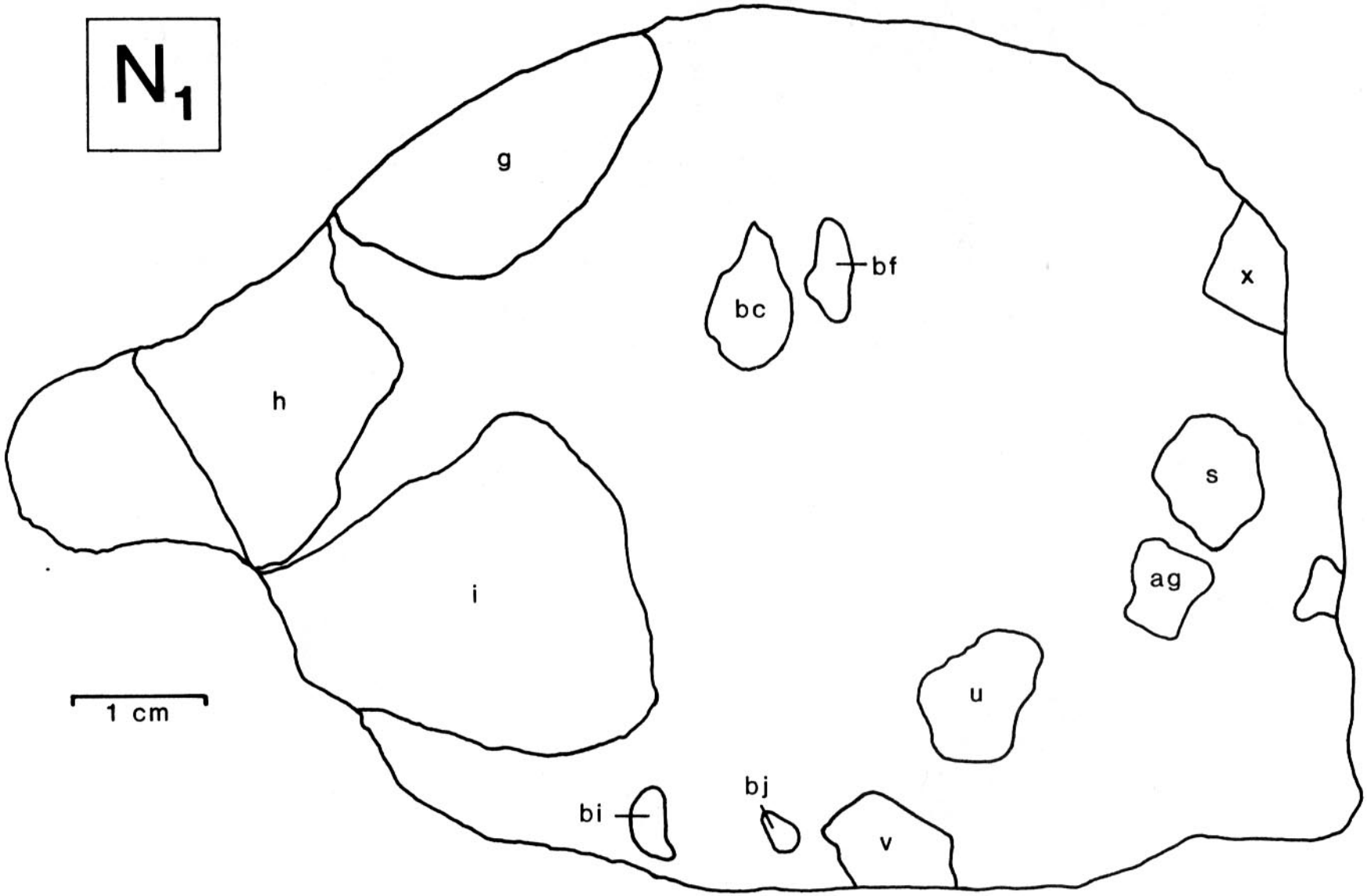
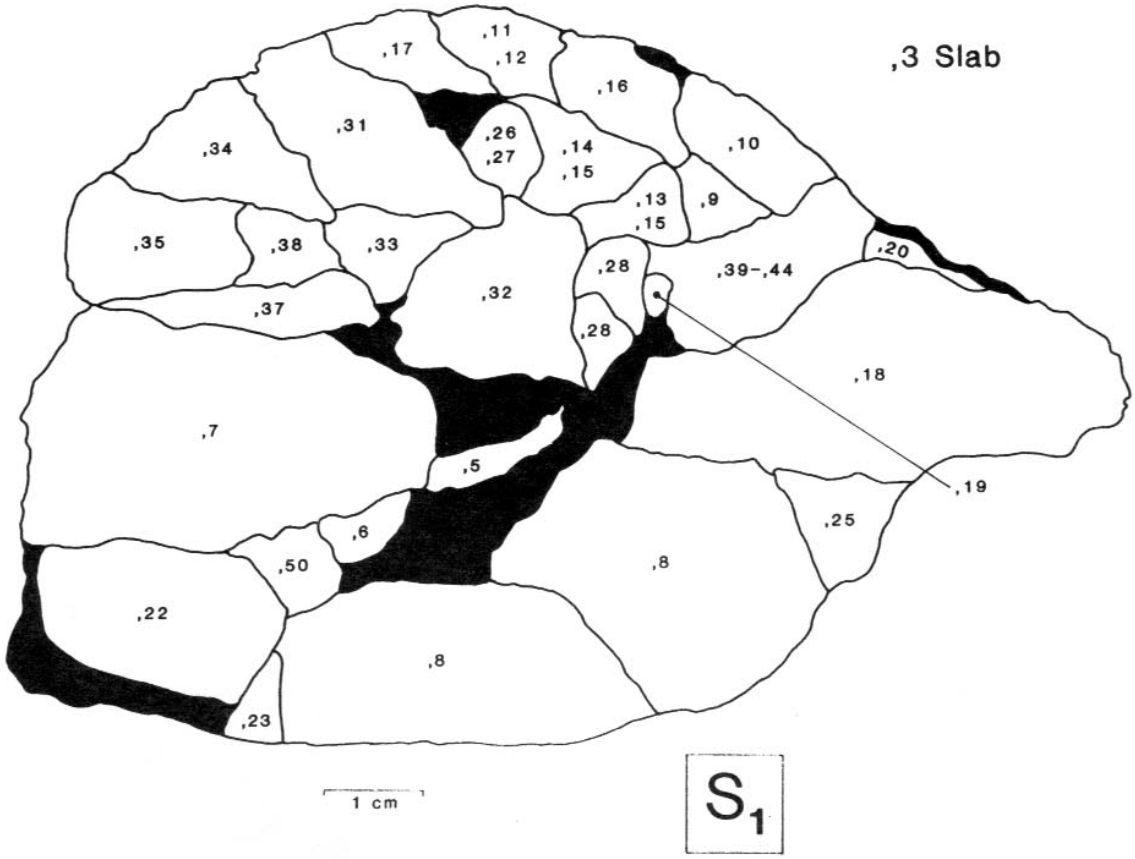


FIGURE 5. Identifies clasts on fresh face of main mass ,1.



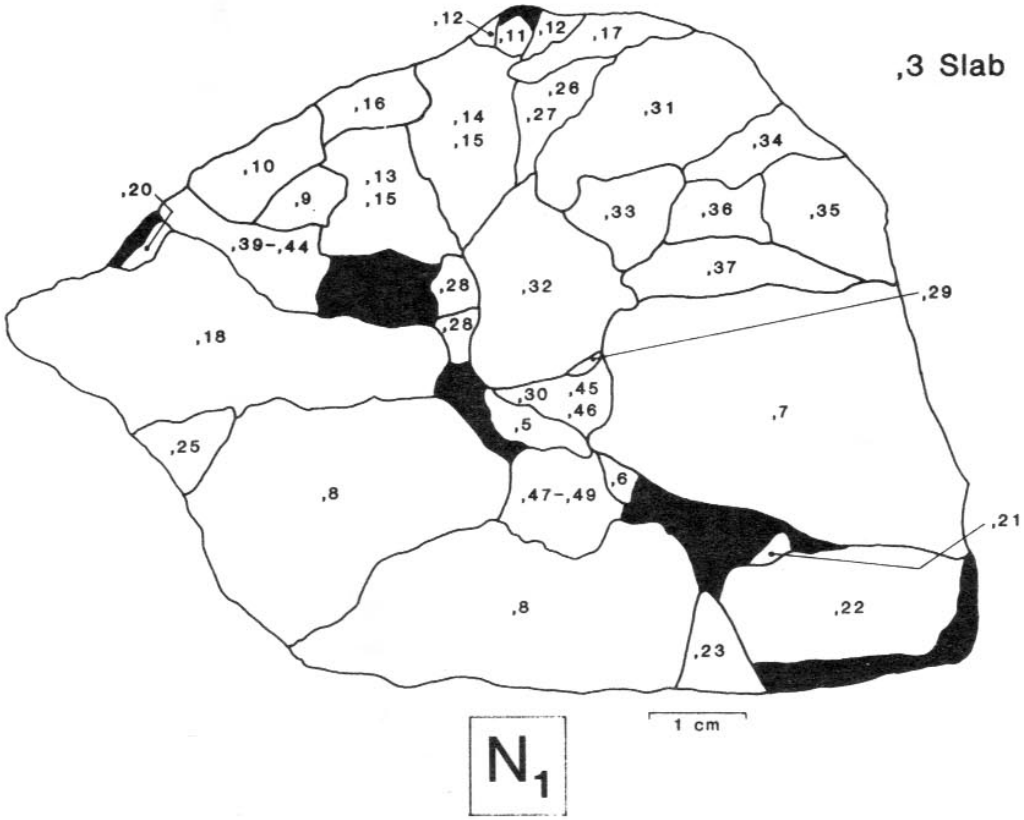


FIGURE 6. Illustrates the original splitting of the large slab in May 1984.

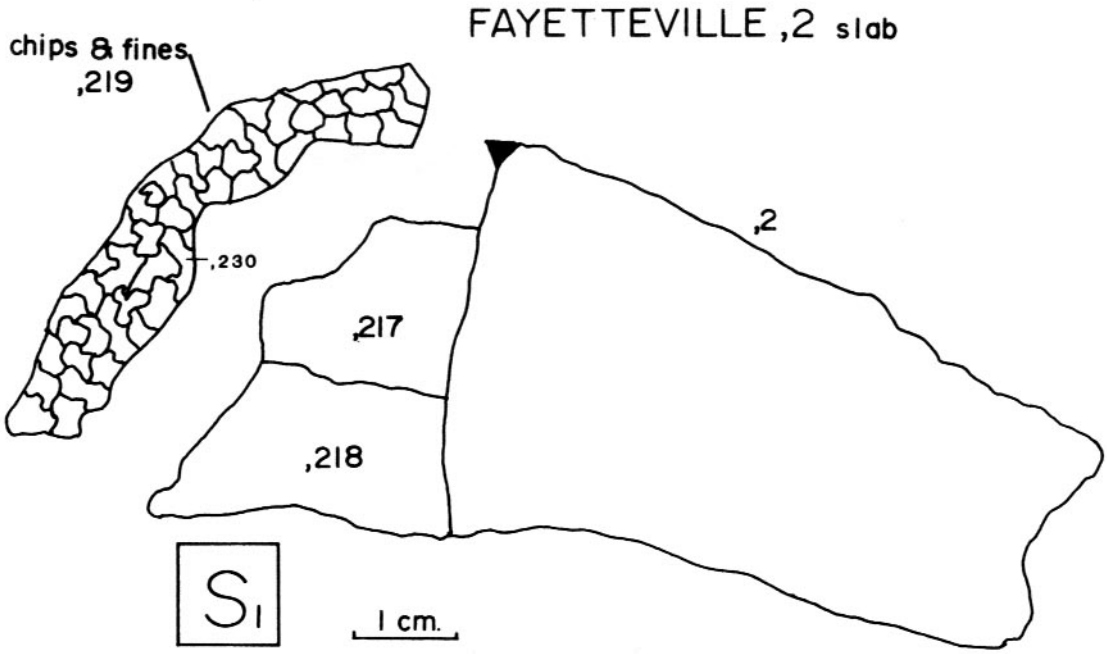


FIGURE 7. Identifies the splits from the small slab ,2.

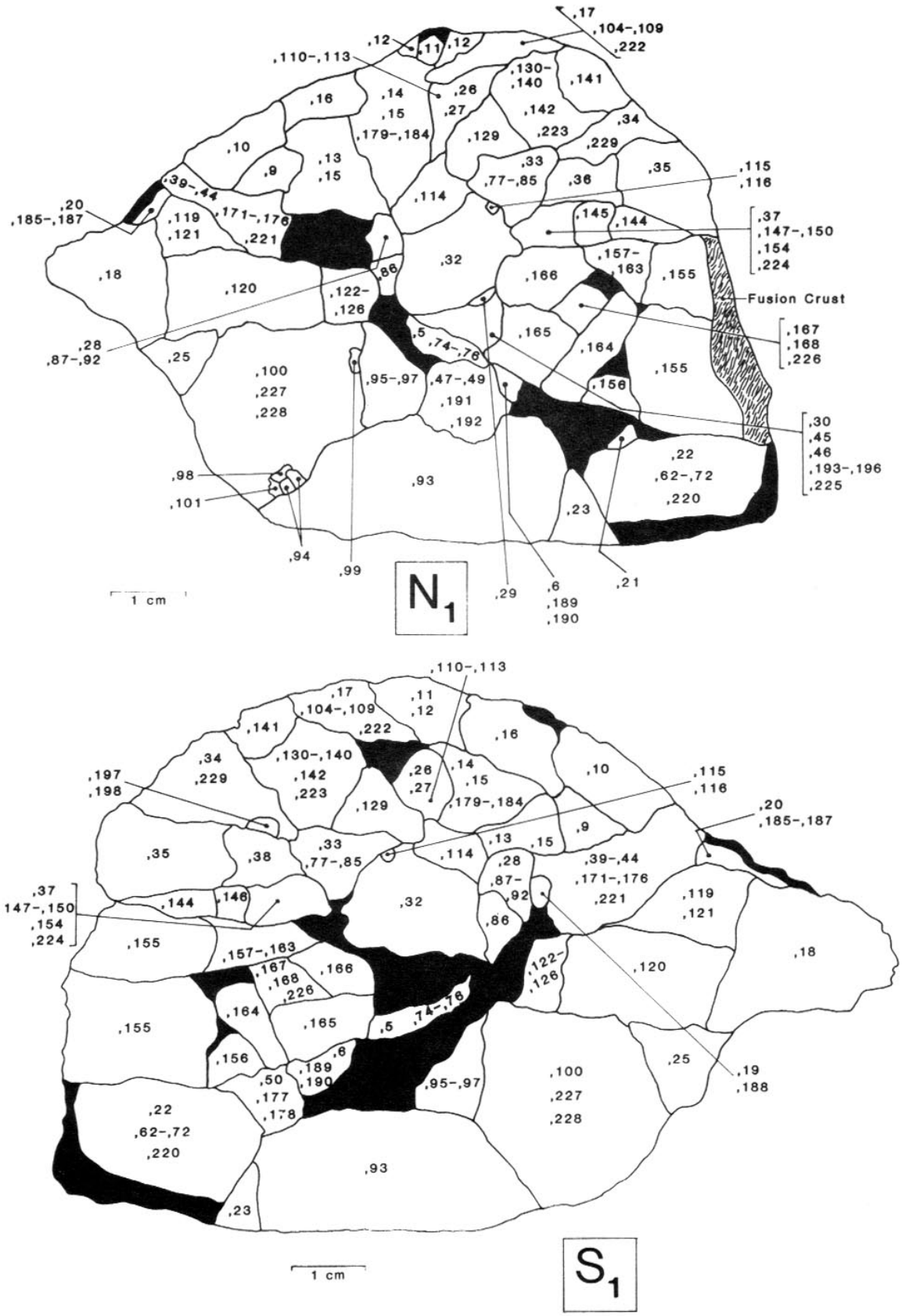


FIGURE 8. Identifies the splits from the north and south faces of ,3.

TABLE I

FAYETTEVILLE METEORITE
ALLOCATIONS BY SPLIT

Split 1,	1473.3g	(Arkansas)		
,24	8.049g	Signer	Matrix chips	
Split 2,	64.9g	*slab*		
,217	9.160g	Signer	Matrix, clast-contaminated	
,218	7.415	JSC	Clast k, an, and matrix	
,219	4.685	JSC	Matrix chips with ar and fusion crust	
,230	1.275	Britt	Clast contam. matrix	
,2	42.355	JSC	Slab	
Split 5,	1.1g,	*interior doc cp*		
,74	0.066g	Hohenberg	2 matrix chips	
,75	0.064	Rajan	Matrix chips	
,76	0.059	Sears	2 matrix chips	
,5	0.896	Dodd	Matrix chip	PTS ,151
Split 6,	600mg,	*chip with ak*		
,189	0.018g	Sears	Clast ak	
,190	0.007	JSC	Clast ak	
,6	0.578	JSC	Chip, ak removed	
Split 7,	21.4g,	*doc chip*		
,155	9.009g	Pellas	2 chips with s,ag,ar	
,156	1.303	Pellas	Chip	
,157	0.535	JSC	an chips	
,158	0.965	JSC	an and matrix chips	
,159	0.225	Lipschutz	3 matrix chips	
,160	0.103	Rao/Goswami	3 matrix chips	
,161	0.069	Hohenberg	3 matrix chips	
,162	0.112	Sears	2 matrix chips	
,163	0.068	Rajan	3 matrix chips	
,164	2.021	Kerridge	Matrix chip	
,165	2.029	Pepin	Matrix chip	
,166	2.065	Epstein	Matrix chip	
,167	1.219	Dodd	Matrix chip	PTS ,208
		Britt		PTS ,231
,168	0.542	JSC	2 chips	
,169	1.171	Signer	Chips and fines	
,226	0.097	Pillinger	Matrix chip	
Split 8,	28.1g,	*2 cps with i,v,bg,af,al,ae*		
,93	13.563g	Pellas	Doc chip, with v	
,94	0.345	Pellas	Clast i cps	
,95	0.098	Scott	as and matrix	PTS ,153
,96	0.585	JSC	as and matrix	
,97	0.044	JSC	as chips	
,98	0.059	Sears	Clast i chips	

,99	0.100	Moore	Matrix cps	
,100	11.258	JSC	Chip, mostly i	
,101	0.628	JSC	Clast i and matrix	
,102	0.617	Signer	Chips and fines	
,227	0.099	Pillinger	Dark matrix chips	
,228	0.678	JSC	Chips and fines	

Split 13, 1.5g, *"clean g"*

,13	1.487g	Pellas	Clast g	

Split 14, 2.8g, *"clean g"*

,179	0.104g	Sears	Clast g	
,180	1.043	D. McKay	Clast g	
,181	0.109	Moore	Clast g	
,182	0.218	Lipschutz	Clast g	
,183	0.108	Rao/Goswami	Clast g	
,184	0.154	Laul	Clast g	
,14	1.026	Britt	Clast g	

Split 17, 2.0g, *matrix b*

,104	0.219g	Lipschutz	2 matrix b chips	
,105	0.113	Rao/Goswami	2 matrix b chips	
,106	0.057	Hohenberg	2 Matrix b chips	
,107	0.056	Rajan	Matrix b chipp	
,108	0.058	Sears	2 matrix b chips	
,109	0.525	JSC	Matrix b chips	
,17	0.891	JSC	Chips and fines	
,222	0.120	Pillinger	Matrix b chips	

Split 18, 19.2g, *chip with h,i,ai*

,119	0.903g	JSC	Clast h chip	
,120	5.933	JSC	Chip with i, h	
,121	1.495	JSC	Clast h cps	
,122	0.215	Lipschutz	4 matrix chips	
,123	0.124	Rao/Goswami	2 matrix chips	
,124	0.065	Hohenberg	2 matrix chips	
,125	0.066	Rajan	Matrix chip	
,126	0.066	Sears	Matrix chip	
,127	0.948	JSC	Chips and fines	
,18	9.254	Pellas	Chip with h	

Split 19, 80mg, *clean z*

,188	0.024g	Scott	Clast z	PTS ,211
,19	0.05	Sears	Clast z chips	

Split 20, 200mg, *clean h*

,185	0.106g	Laul	Clast h	
,186	0.054	Sears	Clast h	
,187	0.048	Scott	Clast h	PTS ,210

Split 21, 300mg, *cp with u*

,21	0.268g	Scott	Chip with u	PTS ,214

Split 22, 6.7g, *matrix region a*

,62	0.050g	Hohenberg	2 matrix a chips	
,63	0.221	Lipschutz	2 matrix a chips	
,64	0.109	Rao/Goswami	Matrix a chip	
,65	1.005	D. McKay	Matrix a chip	
,66	0.063	Rajan	Matrix a chip	
,67	0.054	Sears	Matrix a chip	
,68	0.130	Laul	Matrix a chip	
,69	0.119	Moore	Matrix a chip	
,70	1.009	Pepin	Matrix a chips	
,71	2.008	Epstein	Matrix a chips	
,72	1,025	Kerridge	Matrix a chip	
,220	0.120	Pillinger	Matrix a chips	
,22	0.751	JSC	Matrix a chips	

Split 26, 1.6g, *d and b*

,110	0.206g	Lipschutz	Clast d chips	
,111	0.103	Rao/Goswami	Clast d chips	
,112	0.055	Hohenberg	Clast d chips	
,113	0.031	Sears	Clast d chips	
,26	1.255	JSC	Clast b and d chips	

Split 28, 1.8g, *2 interior chips*

,86	0.547g	Dodd		PTS ,152
,87	0.205	Lipschutz	Matrix chip	
,88	0.101	Rao/Goswami	Matrix chip	
,89	0.052	Hohenberg	2 matrix chips	
,90	0.066	Rajan	2 matrix chips	
,91	0.055	Sears	2 matrix chips	
,92	0.05	JSC	Matrix chips	
,28	0.701	JSC	Clast and matrix chips	

Split 30, 2.1g, *matrix chip from r*

,193	0.612g	Dodd	Matrix	PTS ,213
,194	0.215	Lipschutz	Matrix	
,195	0.122	Rao	Matrix	
,196	0.504	Pepin	Matrix	
,225	0.103	Pillinger	Matrix	
,30	0.590	JSC	Matrix	

Split 31, 9.1g, *chip with aq,bf,bc*

,129	2.746g	Scott	Cp with bf, bc-j	PTS ,207
,130	0.206	Lipschutz	3 matrix chips	
,131	0.117	Rao/Goswami	2 matrix chips	
,132	0.056	Hohenberg	2 matrix chips	
,133	0.052	Rajan	3 matrix chips	
,134	0.107	Sears	2 matrix chips	
,135	0.309	Epstein	3 matrix chips	
,136	0.304	Pepin	5 matrix chips	
,137	0.302	Kerridge	3 matrix chips	
,138	0.070	JSC	Clast aq and matrix	
,139	0.115	JSC	Matrix chips	
,140	0.435	JSC	White clast and matrix	
,141	2.662	JSC	Chip with ab and q	
,142	1.458	JSC	Chips and fines	

,223	0.070	Pillinger	Dark matrix chips	

Split 32, 7.3g, *chip with j,bc,y*

,114	2.094g	JSC	Chip, some bc-j,y	
,115	0.056	Sears	Clast bc-j chip	
,116	0.285	JSC	Clast bc-j chips	
,117	0.202	JSC	Chips and fines	
,32	4.661	Pellas	Chip, most of bc-j and be	

Split 33, 2.3g, *chip, some bf*

,77	0.155g	Lipschutz	2 matrix chips	
,78	0.101	Rao/Goswami	Matrix chip	
,79	0.056	Hohenberg	Matrix chip	
,80	0.081	Sears	3 matrix chips	
,81	0.110	Moore	3 matrix chips	
,82	0.056	Rajan	4 matrix chips	
,83	0.923	JSC	Clast and matrix cps	
,84	0.119	JSC	Clast bf & matrix	
,85	0.233	JSC	Clast bc & matrix	
,33	0.490	JSC	Chips and fines	

Split 34, 3.5g, *chip with ap,ac and fusion crust*

,197	0.025g	Lipschutz	Area e chips	
,198	0.096	JSC	Chips	
,229	0.112	Pillinger	Dark matrix chip	
,34	3.31	JSC	Chip with bd,ac,ap, no e	

Split 37, 3.3g, *k and matrix*

,144	0.800g	Scott	ar,an and matrix	PTS ,205
,145	0.457	Scott	Chip with k	PTS ,206
,146	0.523	JSC	Doc chip	
,147	0.107	Lipschutz	3 clast k chips	
,148	0.067	Rao/Goswami	2 clast k chips	
,149	0.038	Hohenberg	2 clast k chips	
,150	0.036	Rajan	3 clast k chips	
,154	0.035	Sears	Clast k chip	
,224	0.076	Pillinger	Matrix chips	
,37	1.123	JSC	1 chips, fines	

Split 38, 700mg, *cp with e,ah*

,38	0.736g	Dodd	Chip	PTS ,212

Split 39, 1.6g, *c chips*

,171	0.318g	Lipschutz	5 matrix c chips	
,172	0.116	Rao/Goswami	Matrix c chip	
,173	0.059	Hohenberg	Matrix c chip	
,174	0.059	Rajan	2 matrix c chips	
,175	0.062	Sears	2 matrix c chips	
,176	0.509	Pepin	Matrix c chips	
,221	0.106	Pillinger	4 matrix c chips	
,39	0.367	JSC	Matrix c cps and fines	

Split 41, 30 mg, *clean p*

,41	0.029g	Lipschutz	Clast p	

Split 46, 20mg, *clean r*

,46	0.017	Lipschutz	Clast r	

Split 48, 300mg, *clean m*

,191	0.100	Lipschutz	Clast m	
,192	0.052	Rao	Clast m	
,48	0.151	JSC	Clast m	

Split 50, 400mg, *clast u*

,177	0.057g	Sears	Clast u chip	
,178	0.116	Scott	Clast u	PTS ,209
,50	0.185	Pellas	Clast u chips	

TABLE II

FAYETTEVILLE ALLOCATIONS

SPLIT	PTS	LOCATION	WEIGHT (g)	DESCRIPTION
1		Arkansas	1473.3	
2		JSC	42.4	Slab
3		SUBDIVIDED	146.2	Slab
4		JSC	26.4	Band saw fines
5	151	Dodd, R	0.9	Interior chip
6		JSC	0.6	Chip, no ak
9	52	Scott,E	1.1	Clast g
	215	McKay, D		
10		JSC	2.8	g + f.c.
11	53	Scott, E	0.1	chip + t
12		JSC	1.1	Chip + f.c.
13		Pelas, P	1.5	Clast g
14		Britt, D	1.0	Clast g
15		JSC	0.8	g + matrix
16		JSC	1.9	g + f.c.
17		JSC	0.9	Matrix b
18		Pellas, P	9.2	Chip + h
19		Sears, D	0.05	Clast z
21	214	JSC	0.3	Chip + n
22		JSC	0.7	Matrix a
23	54	Dodd, R	1.3	Matrix a
	216	McKay, D		
24		Signer, P	8.0	Chips + fines
25	55	Scott, E	2.1	i and f.c.
26		JSC	1.2	d and b
27	56	Dodd, R	0.1	Chip + d
28		JSC	0.7	Interior chips
29		JSC	0.3	Interior chip
30		JSC	0.6	Matrix cps, r
32		Pellas, P	4.7	Cp + j,bc-j,be
33		JSC	0.5	Cp, some bf
34		JSC	3.3	Cp,+ ap,ac,bd
35		JSC	5.4	ar,x,bh, f.c.
36	57	Scott, E	1.3	k and matrix
37		JSC	1.1	2 chips + fi
38	212	Dodd, R	0.7	Cp with e,ah
39		JSC	0.4	c + fines
40	58	Dodd, R	0.1	c chips
41		Lipschutz, M	0.03	p chips
42	59	Scott, E	0.2	p chips
43		JSC	0.04	Dark clast
44		JSC	0.03	p and matrix
45	60	Dodd, R	0.03	Clast r
46		Lipshutz, M	0.02	Clean r
47	61	Scott, E	0.06	Clast m
48		JSC	0.2	Clean m
49		JSC	0.8	m + matrix

50		Pellas,P	0.2	Clast u
62		Hohenberg, C	0.05	Matrix a
63		Lipschutz, M	0.2	Matrix a
64		Rao, M	0.1	Matrix
65		McKay, D	1.0	Matrix a
66		Rajan, R	0.06	Matrix a
67		Sears, D	0.05	Matrix a
68		Laul, JC	0.1	Matrix a
69		Moore, CB	0.1	Matrix a
70		Pepin, RO	1.0	Matrix a
71		Epstein, S	2.0	Matrix a
72		Kerridge, J	1.0	Matrix a
74		Hohenberg, C	0.07	Matrix
75		Rajan, R	0.06	Matrix
76		Sears, D	0.06	Matrix
77		Lipschutz, M	0.2	Matrix
78		Rao, M	0.1	Matrix
79		Hohenberg, C	0.06	Matrix
80		Sears, D	0.1	Matrix
81		Moore, C	0.1	Matrix
82		Rajan, R	0.06	Matrix
83		JSC	0.9	Clast + matrix
84		JSC	0.1	bf and matrix
85		JSC	0.2	bc and matrix
86	152	JSC	0.5	Matrix
87		Lipschutz, M	0.2	Matrix
88		Rao, M	0.1	Matrix
89		Hohenberg, C	0.05	Matrix
90		Rajan, R	0.07	Matrix
91		Sears, D	0.06	Matrix
92		Pillinger, C	0.05	Matrix
93		Pellas, P	13.6	Chip + v
94		Pellas, P	0.3	Clast i
95	153	Scott, E	0.1	as + matrix
96		JSC	0.6	as + matrix
97		JSC	0.04	as chips
98		Sears, D	0.06	Clast i
99		Moore, C	0.1	Matrix
100		JSC	11.3	Mostly i
101		JSC	0.6	i + matrix
102		Signer, P	0.6	Chips + fines
104		Lipschutz, M	0.2	Matrix b
105		Rao, M	0.1	Matrix b
106		Hohenberg, C	0.06	Matrix b
107		Rajan, R	0.06	Matrix b
108		Sears, D	0.06	Matrix b
109		JSC	0.5	Matrix b
110		Lipschutz, M	0.2	Clast d
111		Rao, M	0.1	Clast d
112		Hohenberg, C	0.06	Clast d
113		Sears, D	0.03	Clast d
114		JSC	2.1	bc-j, y
115		Sears, D	0.06	bc-j chip
116		JSC	0.3	bc-j chips

117		JSC	0.2	Chips + fines
119		JSC	0.9	Clast h
120		JSC	5.9	Chip with i,h
121		JSC	1.5	Clast h
122		Lipschutz, M	0.2	Matrix
123		Rao, M	0.1	Matrix
124		Hohenberg, C	0.06	Matrix
125		Rajan, R	0.07	Matrix
126		Sears, D	0.07	Matrix
127		JSC	0.9	Chips + fines
129	207	Scott, E	2.7	bf, bc-j
130		Lipschutz, M	0.2	Matrix
131		Rao, M	0.1	Matrix
132		Hohenberg, C	0.06	Matrix
133		Rajan, R	0.05	Matrix
134		Sears, D	0.1	Matrix
135		Epstein, S	0.3	Matrix
136		Pepin, R	0.3	Matrix
137		Kerridge, J	0.3	Matrix
138		JSC	0.1	aq + matrix
139		JSC	0.1	Matrix
140		JSC	0.4	White + ma
141		JSC	2.7	Cp with ab,q
142		Signer, P	1.5	Chips + fines
144	205	Scott, E	0.8	Matrix, ar,an
145	206	Scott, E	0.5	Chip with k
146		JSC	0.5	Doc chip
147		Lipschutz, M	0.1	Clast k
148		Rao, M	0.07	Clast k
149		Hohenberg, C	0.04	Clast k
150		Rajan, R	0.04	Clast k
154		Sears, D	0.04	Clast k
155		Pellas, P	9.0	Cp + s,ag,ar
156		Pellas, P	1.3	Chip
157		JSC	0.5	an chips
158		JSC	0.7	an + matrix
159		Lipschutz, M	0.2	Matrix
160		Rao, M	0.1	Matrix
161		Hohenberg, C	0.07	Matrix
162		Sears, D	0.1	Matrix
163		Rajan, R	0.07	Matrix
164		Kerridge, J	2.0	Matrix
165		Pepin, R	2.0	Matrix
166		Epstein, S	2.1	Matrix
167	208	Dodd, R	1.2	Matrix
	231	Britt, D		
168		JSC	0.5	3 chips
169		Signer, P	1.2	Chips + fines
171		Lipschutz, M	0.3	Matrix c
172		Rao, R	0.1	Matix c
173		Hohenberg, C	0.06	Matrix c
174		Rajan, R	0.06	Matrix c
175		Sears, D	0.06	Matrix c
176		Pepin, R	0.5	Matrix c

177		Sears, D	0.06	Clast u
178	209	Scott, E	0.1	Clast u
179		Sears, D	0.1	Clast g
180		McKay, D	1.0	Clast g
181		Moore, C	0.1	Clast g
182		Lipschutz, M	0.2	Clast g
183		Rao, M	0.1	Clast g
184		Laul, JC	0.1	Clast g
185		Laul, JC	0.1	Clast h
186		Sears, D	0.05	Clast h
187	210	Scott, E	0.05	Clast h
188	211	Scott, E	0.02	Clast z
189		Sears, D	0.02	Clast ak
190		JSC	0.007	Clast ak
191		Lipschutz, M	0.1	Clast m
192		Rao, M	0.05	Clast m
193	213	Dodd, R	0.6	Matrix
194		Lipschutz, M	0.2	Matrix
195		Rao, M	0.1	Matrix
196		Pepin, R	0.5	Matrix
197		Lipschutz, M	0.03	Area e
198		JSC	0.1	Chips
217		Signer, P	9.2	Matrix + clast
218		JSC	7.4	a + matrix
219		JSC	4.7	Matrix + f.c.
220		Pillinger, C	0.1	Matrix a chips
221		Pillinger, C	0.1	Matrix c chips
222		Pillinger, C	0.1	Matrix b chips
223		Pillinger, C	0.07	Matrix chips
224		Pillinger, C	0.08	Matrix chips
225		Pillinger, C	0.1	Matrix chips
226		Pillinger, C	0.1	Matrix
227		Pillinger, C	0.1	Matrix
228		JSC	0.7	Chips + fines
229		Pillinger, C	0.1	Dark Matrix
230		Britt, D	1.3	Matrix