SWEENY PROSPECT
104-H
COAL QUALITY FILE

789

M E M O R A N D U M

ESSO RESOURCES CANADA LIMITED
RESEARCH DEPARTMENT

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OCT 23 1984
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RESOURCES GROUP

84 10 18
File: 2647

TO: D. C. D. Parker
A. R. Peach

FROM: J. Allan

RE: Defining Regional Trends in Coal Quality

FILE

Summary

Correlation of volatile matter and/or calorific value with reflectance shows that regional trends of coal quality can be defined in a prospect area. Definition of such trends can be useful for rapid prediction of quality as exploration work progresses and for identifying samples which give unusual analytical results, for whatever reason.

This report deals with high rank coals from the Sweeny prospect as an example, but the concept should be valid in other areas and for other ranks of coal. In the Alberta plains for example, it appears that calorific value and reflectance show a consistent relationship and can be used jointly as regional trend indicators. This approach is particularly useful where reliance has to be placed on outcrop samples in reconnaissance work.

Introduction

I have analyzed thirty coal samples for volatile matter and heating value, in addition to the reflectance analyses which were requested (Table 1). The purpose of this memo is to report this quality information and to demonstrate the value of cross-correlating analytical and reflectance data:

a) to establish regional trends in specific prospects, and
b) to identify those samples within a collection which give spurious coal quality results.

This approach is particularly applicable when outcrop samples are used for prospect assessment.

Volatile Matter and Reflectance

Figure 1 shows volatile matter (d.a.f.) plotted against the mean maximum reflectance of vitrinite. The regional trend band has been drawn in to enclose those samples which were identified under the microscope as being of acceptable quality, i.e. non to marginally weathered, and free of significant carbonate minerals. High ash samples (> 25 wt. %), as determined

by proximate analysis, have been indicated by a discrete identifying symbol as this is another factor which influences volatile matter.

The trend gives an immediate and clear view of the coal quality within the prospect area free of the influences of spurious samples, and demonstrates that a rational relationship exists between V.M. and R_{max}, as would be anticipated. If exploration and sampling was on-going, the trend could be used predictively through measurement of R_{max}, for rapid quality assessment.

A second point is that the quality of the spurious samples (in this case, spurious data are due mostly to weathering effects) can be estimated by re-plotting the data points, R_{max} being constant, within the regional trend zone. In the present suite, only two samples were found where R_{max} itself may be affected by weathering alteration.

Calorific Value and Reflectance

Figure 2 shows the relationship between calorific value and mean maximum reflectance. Once again, a regional trend is apparent, enclosing most of the samples verified by microscopy. In this case, only small differences exist in heating value in high rank coals, so the principal value of these data lies in estimating the true heating value of clean coal for the samples which are either weathered or contain excessive mineral matter.

Calorific Value and Volatile Matter

Figure 3 shows a crossplot of heating value and volatile matter, both on d.a.f. basis. The data here fall into two distinct fields, with weathering as the main factor in differentiating the two groups. However, as both C.V. and V.M. are in error for the altered samples, estimation of either property to an unaltered basis is not possible with the same resolution as can be achieved by using reflectance as an independent control.

Rank Assessment of Sweeny Coals

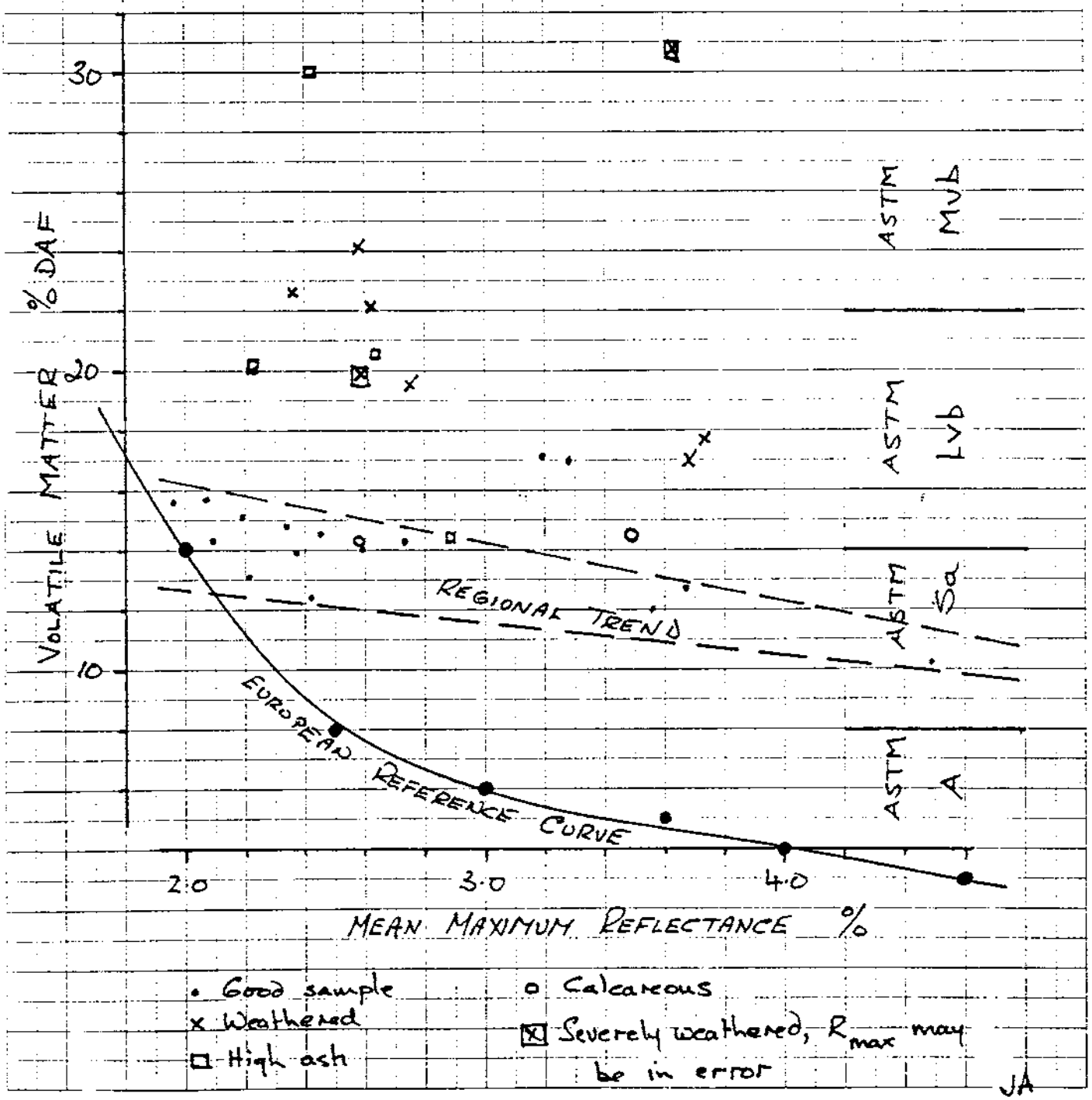
Using the A.S.T.M. classification, the regional trend of volatile matter shows that coal rank ranges from low-volatile bituminous to semi-anthracite. This conflicts quite strongly with the reflectance rank (semi-anthracite to anthracite) using reflectance correlations established for European coals. For comparison, I have shown on figure 1 a European reference curve of V.M. against R_{max}, and the divergence of Sweeny coals is very clear. Unfortunately, the reason isn't readily apparent. Possible explanations are geological - rapid burial under high geothermal gradients for Sweeny coals, or high maximum reflectances induced by shearing stresses. I intend to do more work on this, time permitting. I do not think this difference negates the idea of using reflectance for either defining regional quality trends or rank mapping because of the internal consistency, but for utillzation potential I would suggest using the regional trend volatile matters for ranking these coals until an explanation is forthcoming.

JA/mpa

cc: J. R. Rawling

FIGURE 1.

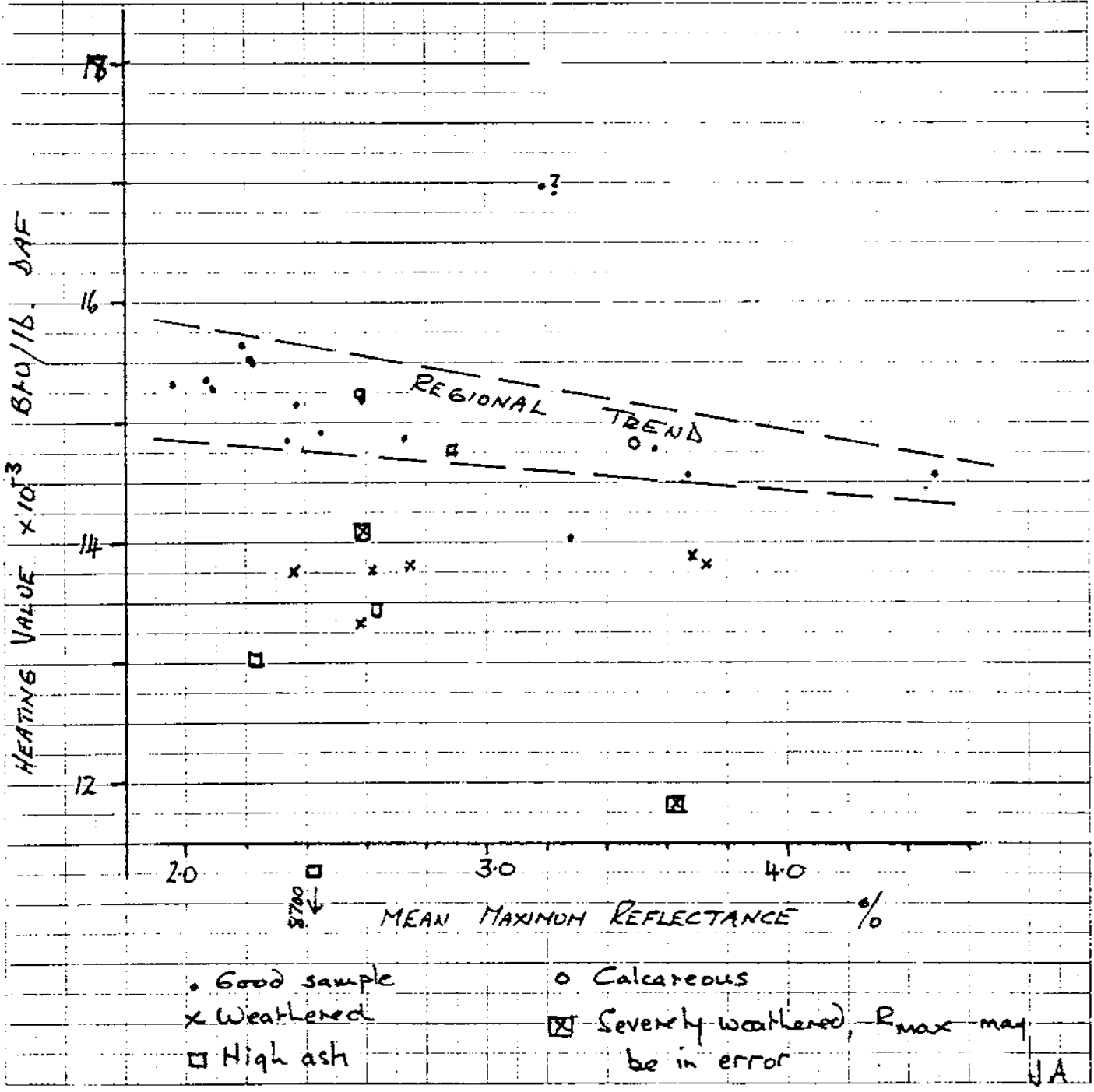
SWEENY PROSPECT - RELATIONSHIP BETWEEN VOLATILE MATTER AND VITRINITE REFLECTANCE



JA
84-10-22

FIGURE 2

SWEENY PROSPECT - RELATIONSHIP BETWEEN HEATING VALUE AND VITRINITE REFLECTANCE

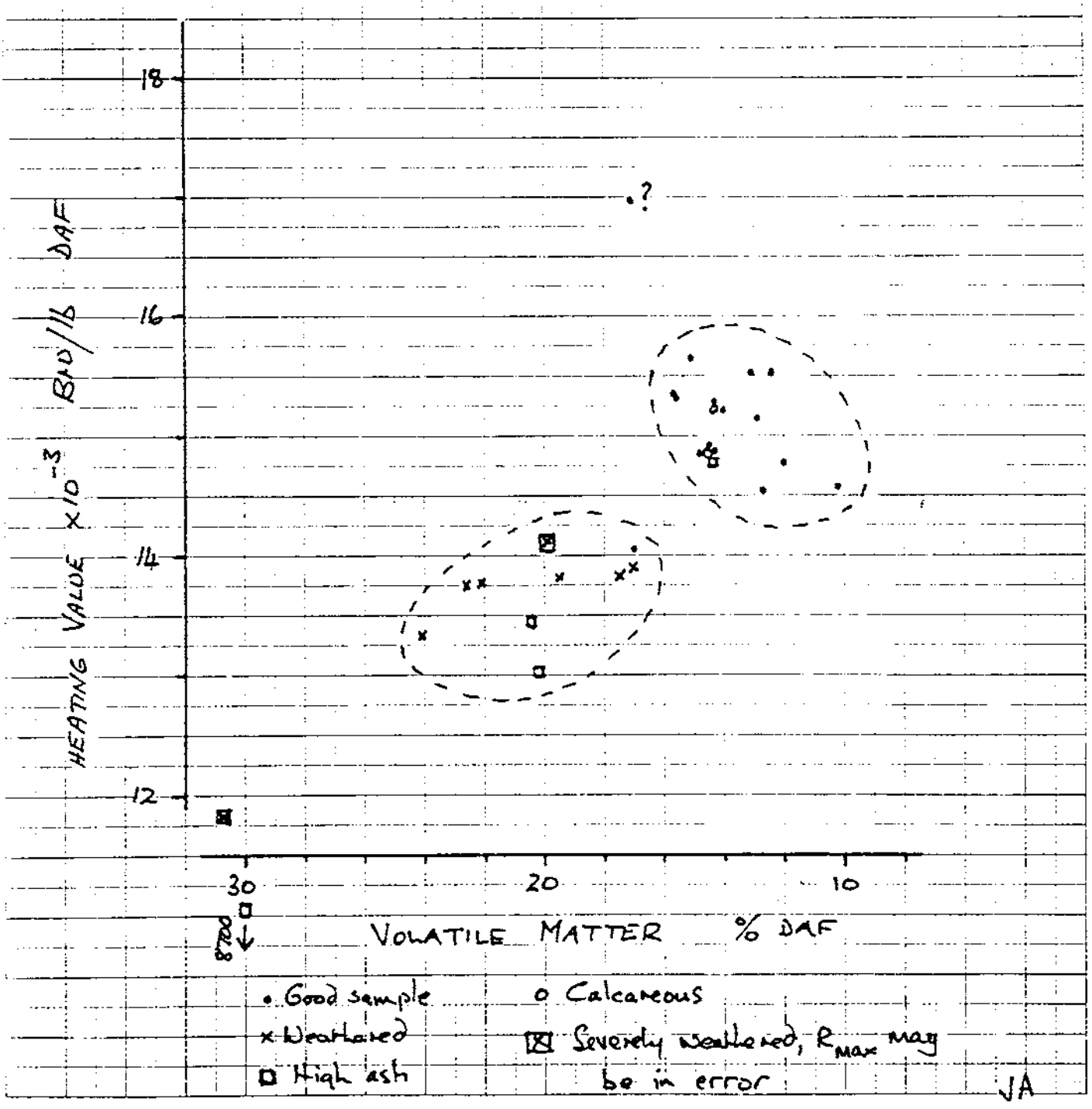


JA

84-10-22

FIGURE 3

SWEENY PROSPECT – RELATIONSHIP BETWEEN HEATING VALUE AND VOLATILE MATTER CONTENT



JA

84-10-22

TABLE 1

SWEENY PROSPECT - ANALYTICAL DATA

	H_2O	VOL %	ASH %	BTU/LB	VOL %	BTU/LB	P_{MAX}
	AS RECEIVED				DAF		
R253/	0.69	13.08	7.77	13625	14.3	14884	2.73
R254/	3.54	8.98	8.04	12894	10.2	14583	4.49
DK80	1.60	15.38	8.27	12661	17.0	14047	3.28
JD11 U	2.10	19.24	10.70	12010	22.1	13773	2.62
JS20	8.45	17.82	12.81	10830	22.6	13754	2.36
JS45	5.53	11.34	39.16	7439	20.5	13450	2.63
JS53 CHAN	1.33	10.41	26.17	10716	14.4	14781	2.88
JS63	2.95	12.71	6.04	13842	14.0	15209	2.59
JS78 CHAN	3.63	9.54	16.64	11792	12.0	14790	3.56
T84016	2.39	13.54	11.49	13233	15.7	15366	2.07
T84021	4.22	11.27	14.80	12275	13.9	15158	2.37
T84114	1.72	11.67	9.44	13801	13.1	15535	2.21
T84116 A	2.93	13.20	9.84	13655	15.1	15654	2.19
T84116 B	1.55	12.29	19.73	12056	15.6	15315	1.96
TB84005	14.88	19.20	22.71	7384	30.6	11831	3.63
B84002 AB	0.42	12.04	16.34	12412	14.5	14911	2.45
B84020	1.11	12.58	10.75	13483	14.3	15297	2.09
B84059	2.06	12.02	14.62	12336	14.5	14841	3.49
B84076B	3.67	10.88	42.47	7015	20.2	13025	2.22
IP84008	1.32	8.28	71.08	2400	30.0	8696	2.41
T84003	3.40	10.61	10.75	13329	12.4	15526	2.22
T84004	2.08	10.98	23.53	11049	14.8	14853	2.34
T84008	0.28	12.80	10.47	13599	14.3	15237	2.58
T84033	5.88	12.40	21.51	12329	17.1	16979	3.19
T84094	7.18	16.06	10.26	11396	19.5	13803	2.75
T84097	11.39	19.49	7.62	10804	24.1	13340	2.58
T84103	7.69	16.97	7.07	12024	19.9	14106	2.59
R175 CHAN	3.88	14.67	13.17	11473	17.7	13831	3.73
R177	2.69	11.25	8.43	12947	12.7	14567	3.67
K002 CHAN	3.52	13.59	16.68	11088	17.0	13895	3.68

M E M O R A N D U M

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RESEARCH DEPARTMENT

RECEIVED
OCT 23 1984
EMC-COAL
RESOURCES GROUP

84 10 18
File: 2647

CC: ARP
GJO
Files

Letter No: 45191

TO: A. R. Peach

FROM: J. Allan

RE: Sweeny Prospect - Reflectance Analysis

The reflectance data which you requested are attached. The quoted values of reflectance refer to mean maximum reflectance, and S is the standard error of the mean. A rank estimate is indicated based on reflectance, with a value of 2.5% taken as the boundary between semi-anthracite and anthracite. Two samples are flagged with an asterisk (*) - the reflectance values of these may be depressed because of severe weathering.

I have added comments, as applicable, on the microscopic fabrics or characteristics. When interpreting volatile matter data, samples indicated as weathered or shaley, or calcareous may have enhanced volatiles. The pyritic notation indicates syngenetic framboidal pyrite, which ususally implies brackish influences at deposition.

I received two samples marked T84116, and T84115 was missing. I labelled the pair A and B. If you have ash data on T84115 and T84116, the lower ash sample (estimated 10%) is my sample T84116B.

I do not think there will be any point in doing maceral analysis. At such high ranks, the optical characteristics of individual macerals are often very similar and the coals appear rather homogeneous. Original sedimentary details are too strongly overwhelmed by the effects of the strong coalification.

The reflectance data cluster into two main groups: 21 samples fall in the range 1.9-2.9%, straddling the semi-anthracite - anthracite boundary. The second group of 8 samples are higher rank - in the range of 3.2 - 3.7%. One remaining sample (R254) is very high rank, and is the only one in the set to show such severe coalification.

Please supply me with a charge number for this work.

JA/mpa

MEAN MAXIMUM REFLECTANCE ANALYSIS

I.D.	%R MAX.	S.D.	REFLECTANCE RANK	COMMENTS
R253	2.73	0.02	Anthracite	
R254	4.49	0.06	Anthracite	
DK80	3.28	0.03	Anthracite	
JD11	2.62	0.02	Anthracite	Strongly weathered
JS20	2.36	0.01	Semi-anthracite	Strongly weathered
JS45	2.63	0.02	Anthracite	Shaley
JS53	2.88	0.015	Anthracite	Fractured, mildly weathered
JS63	2.59	0.015	Anthracite	Mildly weathered
JS78	3.56	0.025	Anthracite	
T84016	2.07	0.01	Semi-anthracite	Fractured, folded, brecciated pyritic, minor calcite.
T84021	2.37	0.02	Semi-anthracite	Fractured, folded, pyritic
T84114	2.21	0.01	Semi-anthracite	Minor pyrite
T84116A	2.19	0.02	Semi-anthracite	Fractured, folded, pyritic, mildly weathered, minor calcite.
T84116B	1.96	0.02	Semi-anthracite	Fractured, pyritic
*T884005	3.63	0.04	Anthracite	Strongly weathered
B84002	2.45	0.02	Semi-anthracite	
B84020	2.09	0.01	Semi-anthracite	
B84059	3.49	0.025	Anthracite	Fractured, abundant calcite
B84076	2.22	0.02	Semi-anthracite	Shaley, pyritic, weathered
IP84008	2.41	0.035	Semi-anthracite	Carbonaceous shale
T84003	2.22	0.01	Semi-anthracite	Fractured, pyritic
T84004	2.34	0.01	Semi-anthracite	Shaley
T84008	2.58	0.02	Anthracite	Common calcite
T84033	3.19	0.025	Anthracite	Fractured, slightly weathered
T84094	2.75	0.015	Anthracite	Moderately weathered
T84097	2.58	0.025	Anthracite	Strongly weathered
*T84103	2.59	0.02	Anthracite	Strongly weathered
R175	3.73	0.03	Anthracite	Weathered
R177	3.67	0.03	Anthracite	
K002	3.68	0.05	Anthracite	Weathered

M E M O R A N D U M

DATE: 1984 09 21

TO: File

FROM: A.R. Peach

SUBJECT: Coal Rank on Sweeny

Twenty-three coal and non-coal samples were submitted to Loring Laboratories for coal quality analyses. These samples were crushed to pass 19 mm and then tested for proximate analyses, calorific value, sulphur and specific gravity. F.S.I. and Equilibrium Moisture % was conducted on 4 samples while H.G.I. was performed on 5 samples. The results are shown in the attached sheets from Loring.

To establish the rank according to A.S.T.M. standards, the data was manipulated using the Parr Formula and the Approximation Formula for D.M.M.F. Fixed Cargbon as shown below:

Parr Formula:
D.M.M.F. Fixed Carbon = ((FC-0.15S)/[100-(M+1.08A+0.55S)]) x 100

Approximation Formula:
D.M.M.F. Fixed Carbon = (FC/[100-(M+1.1A+0.1S)]) x 100

where:

- Mm = Mineral Matter
- F.C. = Fixed Carbon %
- S = Sulphur %
- M = Equilibrium Moisture %
- A = Ash %

with all quantities based on the equilibrium moisture. The Volatile Matter on this basis is the complement of the Fixed Carbon. Using the samples for which I have obtained Equilibrium Moisture %, the Fixed Carbon and Volatile Matter (D.M.M.F.) were calculated and the rank determined and are listed in Table 1.

To further qualify the rank within the property, 30 samples have been sent to Jim Allan in Research for reflectance studies. These samples are randomly taken from both the fluvial and paralic coal zones and differences or similarities noted as part of a statistical study to be completed during the reporting stage. The results will be available mid-October.

ARP/cyg
3247K

Encls.

A.R. Peach/cyg

COAL RANK - SWEENY

SAMPLE #.	FIXED CARBON (DMMF)		VOLATILE MATTER (DMMF)		COAL RANK
	Parr Fm.	Approximate Fm.	Parr Fm.	Approximate Fm.	
T84009 (Coal)	92.6	92.6	7.4	7.4	Anthracite
K002 (Coal)	86.5	86.8	13.5	13.2	Semi Anthracite
R175 (Coal)	91.0	91.1	9.0	8.9	Semi Anthracite
R176 (Coal)	91.1	91.19	8.9	8.81	Semi Anthracite

To: ESSO RESOURCES CANADA LIMITED
237 - 4th Avenue S.W.,
Calgary,Alberta T2P 0H6
Attn: A.R. Peach

File No. 26781
Date September 11, 198
Samples Coal
P.O.# 02-100810

Certificate of ASSAY

LORING LABORATORIES LTD.

SAMPLE No.	H.G.I (Air Dried)	EQUILIBRIUM MOISTURE
oal Analysis"		
T 84009 Coal	57	2.0
T 84008 Coal	69	-
K 002 Coal	43	7.0
R 175 Coal	40	6.2
R 176 Coal	40	5.9

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.

Pulps Retained one month unless specific arrangements made in advance.

Assayer

ESSO RESOURCES CANADA LIMITED

Attn: G. Ockert

LORING LABORATORIES LTD

CERTIFICATE of COAL TESTING

P.O.# 100144

FILE NO.: 25262

DATE: September 8, 1983

SAMPLE NO.	IDENTIFICATION	SAMPLE TYPE	% RECOVERY			REC'D % H_2O	% H_2O	% VOL. MATTER	% ASH	% FIXED CARBON	% S	BTU /LB.	F.S.I.	
			SINK	FLOAT										
R-253					Air Dryed	-	3.54	9.85	10.30	76.31	.55	12972		
					Dry Basis	-	-	10.21	10.68	79.11	.57	13448		
R254					Air Dryed	-	5.70	6.91	9.34	78.05	.38	12472		
					Dry Basis	-	-	7.33	9.90	82.77	.40	13226		
DK-88					Air Dryed	-	6.68	9.55	6.78	76.99	.51	12504		
					Dry Basis	-	-	10.23	7.27	82.50	.55	13399		

ESSO RESOURCES CANADA LIMITED

Attn: A.R. Peach

LORING LABORATORIES, LTD P.O.# 02-100810

CERTIFICATE of COAL TESTING Page # 4

LIL NO. 26/81

DATE September 1/84

SAMPLE NO.	IDENTIFICATION	SAMPLE TYPE	% RECOVERY SINK	% RECOVERY FLOAT		REC'D % H_2O	% H_2O	% VCL MATTER	% ASH	% FIXED CARBON	% S	BTU /LB.	F.S.I.	SPECIFIC GRAVITY
R 175		Floor			As Received	8.61	-	7.85	71.61	11.93	.19	1174		
					Air Dried	-	2.35	8.39	76.52	12.74	.20	1254		2.14
					Dry Basis	-	-	8.59	78.36	13.05	.20	1284		
R 175		Coal			As Received	8.20	-	8.21	9.34	74.25	.41	11961		
					Air Dried	-	2.97	8.68	9.87	78.48	.43	12642	0	1.41
					Dry Basis	-	-	8.95	10.17	80.88	.44	13029		
R 175		Roof			As Received	7.39	-	4.98	84.86	2.77	.06	419		
					Air Dried	-	1.69	5.29	90.08	2.94	.06	445		2.48
					Dry Basis	-	-	5.38	91.63	2.99	.06	453		
R 175		Channel			As Received	11.55	-	10.18	12.94	65.33	.36	10663		
					Air Dried	-	3.97	11.05	14.05	70.93	.39	11577		-
					Dry Basis	-	-	11.51	14.63	73.86	.41	12056		
R [illegible]		Floor			As Received	3.45	-	4.35	89.27	2.93	.04	931		
					Air Dried	-	1.19	4.45	91.36	3.00	.04	441		2.47
					Dry Basis	-	-	4.50	92.46	3.04	.04	446		
R [illegible]		Coal			As Received	7.68	-	8.20	9.01	75.11	.41	12186		
					Air Dried	-	3.03	8.61	9.46	78.90	.43	12800	0	1.41
					Dry Basis	-	-	8.88	9.76	81.36	.44	13200		

ESSO RESOURCES CANADA LIMITED

Attn: A.R. Peach

LORING LABORATORIES LTD

P.O.# 02-100810

FILE NO.: 26781

CERTIFICATE of COAL TESTING

Page # 3

DATE: September 21/84

SAMPLE NO.	IDENTIFICATION	SAMPLE TYPE	% RECOVERY SINK	% RECOVERY FLOAT		REC'D % H_2O	% H_2O	% VCL MATTER	% ASH	% FIXED CARBON	% S	BTU /LB.	F.S.I.	SPECIFIC GRAVITY
~~B 84002~~	A	Coal			As Received	3.88	-	7.92	18.80	69.40	.45	11716		
	(COMBINED FOR f.o)				Air Dried	-	1.34	8.13	19.30	71.23	.46	12026		1.49
					Dry Basis	-	-	8.24	19.56	72.20	.47	12189		
~~B 84002~~	B	Coal			As Received	3.62	-	8.03	12.82	75.53	.59	12790		
					Air Dried	-	1.34	8.22	13.12	77.32	.60	13093		1.43
					Dry Basis	-	-	8.33	13.30	78.37	.61	13271		
B 84002		Parting			As Received	3.52	-	4.61	90.32	1.55	.01	205		
					Air Dried	-	1.53	4.70	92.18	1.59	.01	209		2.45
					Dry Basis	-	-	4.77	93.61	1.62	.01	212		
B 84005 a	A	Coal			As Received	12.34	-	12.37	27.20	48.09	.30	8280		
					Air Dried	-	4.70	13.45	29.57	52.28	.33	9002		1.62
					Dry Basis	-	-	14.11	31.03	54.86	.35	9446		
B 84005 a	B	Coaly Shale			As Received	11.81	-	10.66	37.13	40.40	.26	6724		
					Air Dried	-	2.69	11.76	40.97	44.58	.29	7419		1.69
					Dry Basis	-	-	12.09	42.10	45.81	.30	7624		
B 84005 a	C	Coaly Shale			As Received	16.12	-	13.15	15.49	55.24	.36	9541		
					Air Dried	-	4.89	14.91	17.56	62.64	.41	10818		1.46
					Dry Basis	-	-	15.68	18.46	65.86	.43	11374		

ESSO RESOURCES CANADA LIMITED

Attn: A.R. Peach

LORING LABORATORIES LTD P.O.# 02-100810

CERTIFICATE of COAL TESTING Page # 2

FILE NO 26/81

DATE Septe r 11/84

SAMPLE NO.	IDENTIFICATION	SAMPLE TYPE	% RECOVERY SINK	% RECOVERY FLOAT		REC'D % H_2O	% H_2O	% VCL MATTER	% ASH	% FIXED CARBON	% S	BTU /LB.	F.S.I.	SPECIFIC GRAVITY
K 002		Floor			As Received	11.13	-	9.19	53.37	26.31	.27	4178		
					Air Dried	-	2.53	10.08	58.53	28.86	.30	4582		1.94
					Dry Basis	-	-	10.34	60.05	29.61	.31	4701		
K 002		Coal			As Received	9.60	-	11.70	9.52	69.18	.47	11461		
					Air Dried	-	3.38	12.51	10.17	73.94	.50	12250	0	1.42
					Dry Basis	-	-	12.95	10.53	76.52	.52	12679		
K 002		Channel			As Received	8.85	-	8.04	34.70	48.41	.27	7601		
					Air Dried	-	3.29	8.53	36.82	51.36	.29	8065		-
					Dry Basis	-	-	8.82	38.07	53.11	.30	8339		
K 001		Coal			As Received	10.87	-	7.83	8.81	72.49	.46	11681		
					Air Dried	-	3.45	8.48	9.54	78.53	.50	12653		1.41
					Dry Basis	-	-	8.78	9.88	81.34	.52	13105		
B 84002		Roof			As Received	4.74	-	4.88	80.89	9.49	.07	1387		
					Air Dried	-	1.56	5.04	83.59	9.81	.07	1433		2.30
					Dry Basis	-	-	5.12	84.91	9.97	.07	1456		
B 84002		Floor			As Received	10.03	-	3.22	85.34	1.41	.04	133		
					Air Dried	-	1.15	3.54	93.76	1.55	.04	146		2.49
					Dry Basis	-	-	3.58	94.85	1.57	.04	148		

ESSO RESOURCES CANADA

Attn: A.R. Peach

LORING LABORATORIES LTD

P.O.# 02-100810

CERTIFICATE of COAL TESTING

FILE NO: 26/81

DATE: September 11/84

SAMPLE NO.	IDENTIFICATION	SAMPLE TYPE	% RECOVERY			REC'D % H_2O	% H_2O	% VCL MATTER	% ASH	% FIXED CARBON	% S	BTU /LB.	F.S.I.	SPECIFIC GRAVITY
			SINK	FLOAT										
T 84009		Coal			As Received	2.84	-	7.40	9.27	80.49	.59	13570		
					Air Dried	-	1.16	7.53	9.43	81.88	.60	13805	0	1.41
					Dry Basis	-	-	7.62	9.54	82.84	.61	13967		
B 84144		Coal			As Received	9.35	-	6.86	31.90	51.89	.18	7206		
					Air Dried	-	6.42	7.08	32.93	53.57	.19	7439		1.64
					Dry Basis	-	-	7.57	35.19	57.24	.20	7949		
T 84008		Coal			As Received	7.32	-	9.07	10.05	73.56	.47	12713		
					Air Dried	-	.71	9.72	10.77	78.80	.50	13620		1.41
					Dry Basis	-	-	9.79	10.85	79.36	.50	13717		
T 84008		Roof			As Received	1.71	-	8.52	89.62	0.15	.37	211		
					Air Dried	-	.81	8.60	90.44	0.15	.37	213		2.49
					Dry Basis	-	-	8.67	91.18	0.15	.37	215		
T 84008		Floor			As Received	5.01	-	7.44	85.23	2.32	.09	373		
					Air Dried	-	1.56	7.71	88.33	2.40	.09	387		2.43
					Dry Basis	-	-	7.83	89.73	2.44	.09	393		
K 002		Roof			As Received	4.26	-	5.72	88.47	1.55	.04	349		
					Air Dried	-	1.23	5.90	91.27	1.60	.04	360		2.46
					Dry Basis	-	-	5.97	92.41	1.62	.04	364		

KEYPUNCH REQUISITION

Level 97, 10

NAME: B. NOLAND PAC. #: HWC0791

PHONE #: 1355

ROOM #: 658 ET PROG. #:

SPECIAL INSTRUCTIONS:

DATE OUTPUT REQUIRED:

FOUR PHASE CONTROL

JOB NAME NOW BATCH NO 115

DATE RECEIVED

ENTERED BY MD

VERIFIED BY SK

DATE TRANSMITTED

SPFADD INPUT SHEET

CARD COL.				
1	4	11	26	45 64
//		,01,UTILS,00),'		',MSGLEVEL=1,CLASS=A

CARD COL.		
1	10	15
//SPFADD	EXEC	SPFADD,USER=P ,NAME='PL40.ARP.SWEENY84.QUAL'

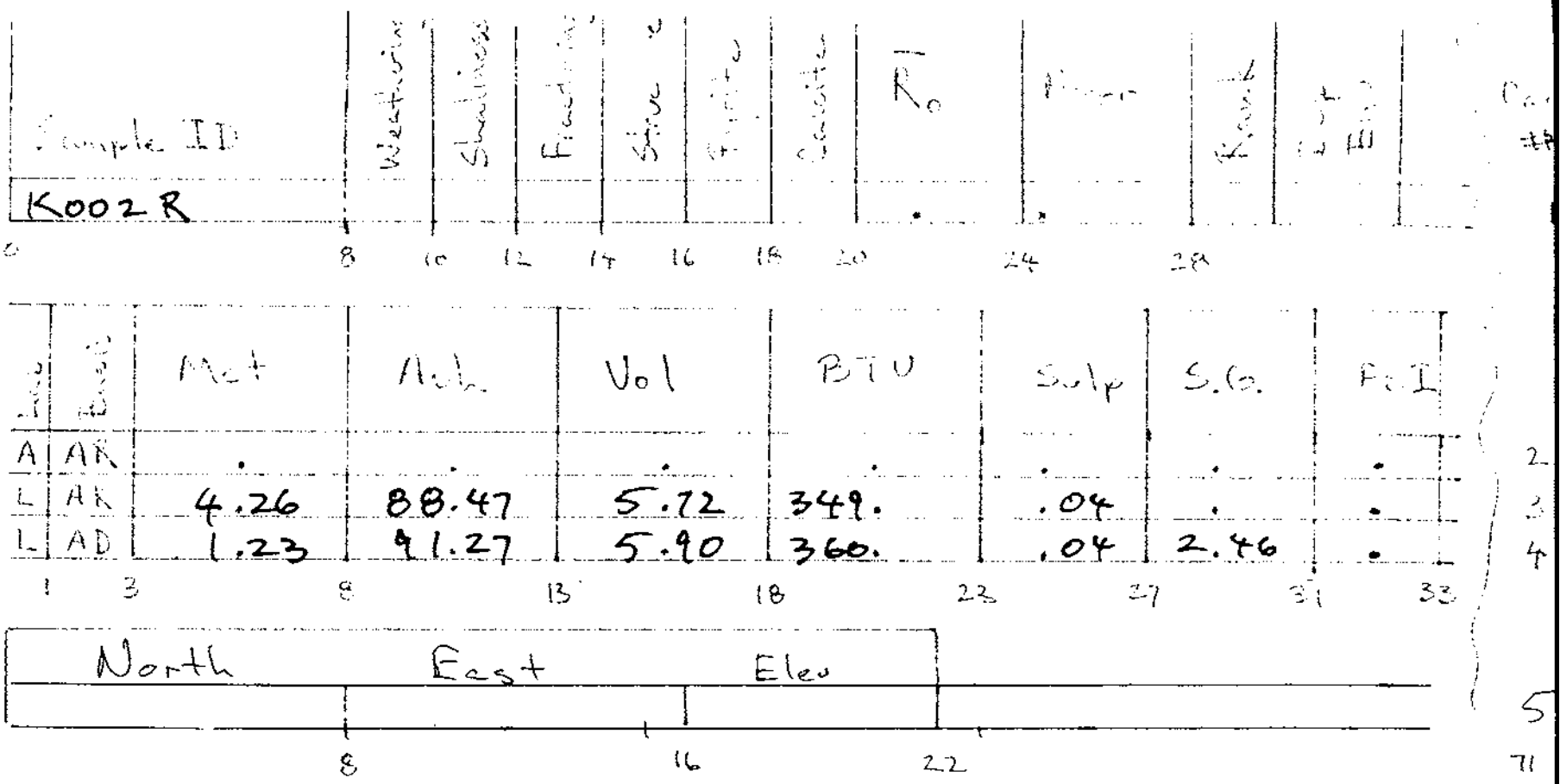
NOTE: THE "NAME" PARAMETER MUST BE ENCLOSED BY QUOT MARKS.

CARD COL.		
1	9	12 15
//INPUT	DD	DATA

DATA HERE

CARD COL.
1
/*

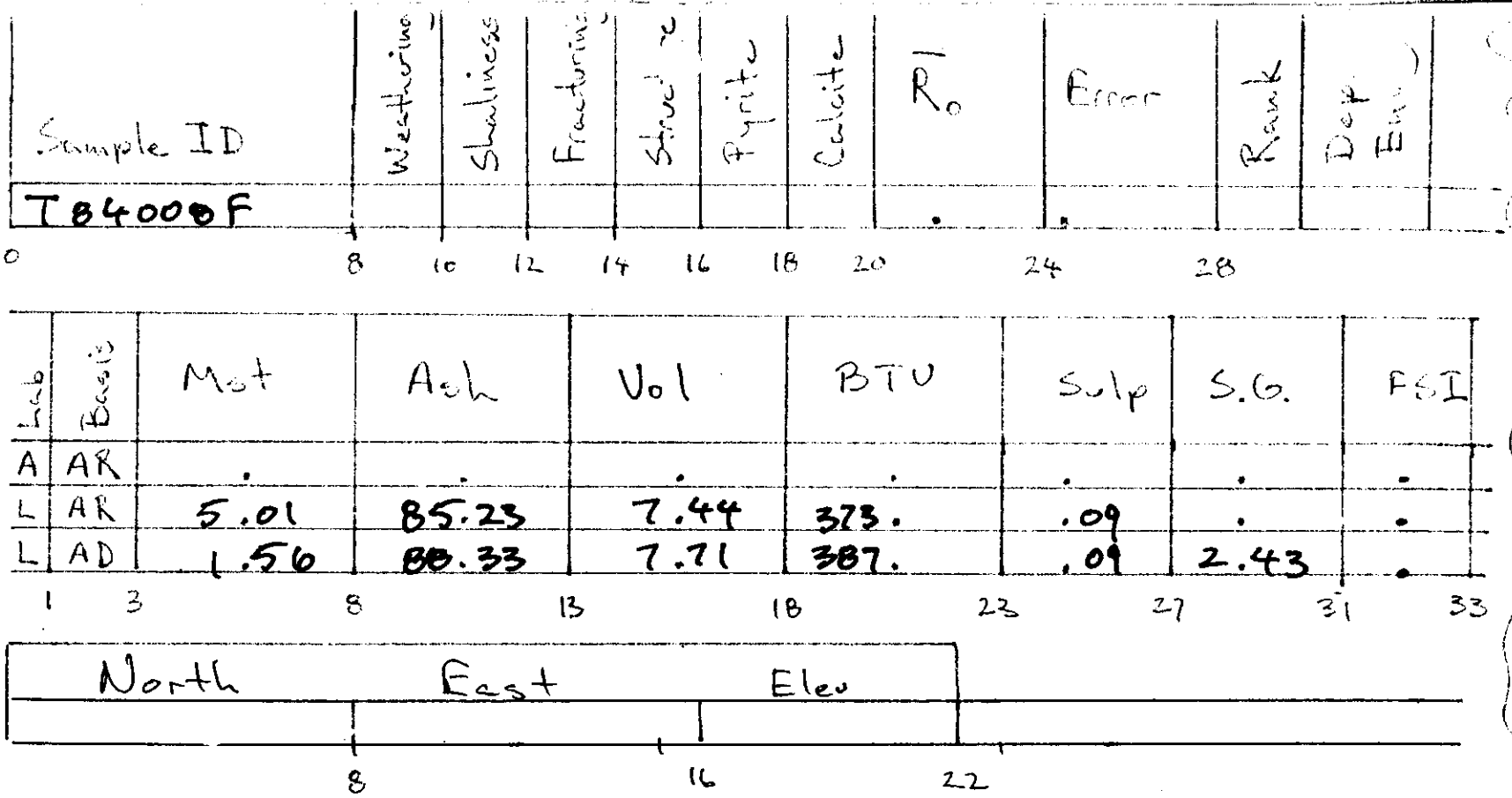
```
                    (***** SPF DATASET ONLY *****)
SPFADD    ADD AN SPF DATASET IN BATCH
          USER = P???
          NAME = 'XXXXXXX'  SPF DATASET NAME
          PRIME = PP        PRIMARY SPACE ALLOCATION (TRKS) (DEFAULT = 2
          SECOND = SS       SECONDARY SPACE ALLOC. (TRKS) (DEFAULT = 2)

NOTE:     IF THE DATASET IS TO BE CREATED FROM OTHER THAN CARDS,
          IE: TAPE, THEN OVER RIDE //INPUT TO POINT TO A TAPE
          DATASET.
```



Key punch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data



Keypunch

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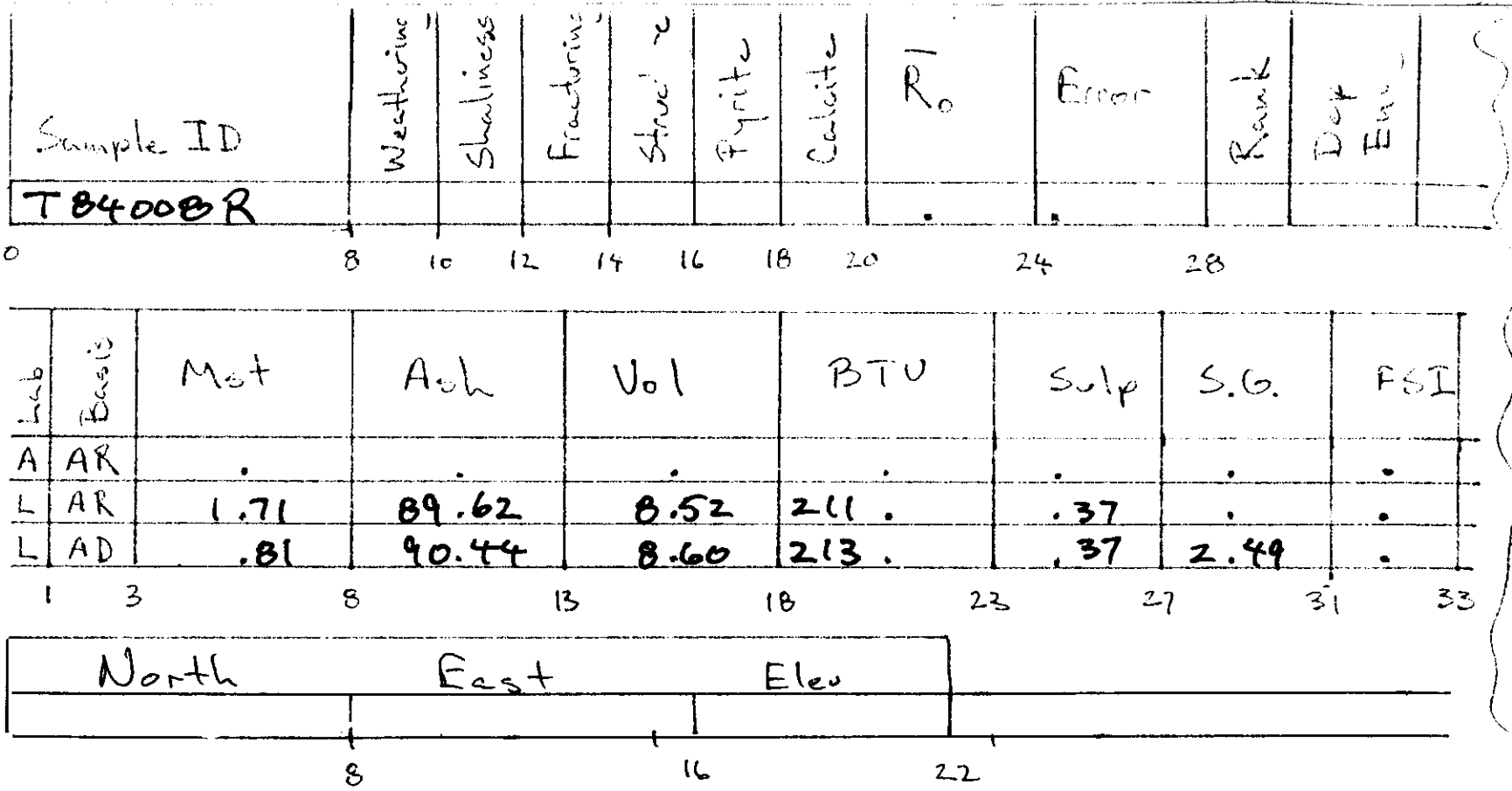


Key punch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data

Sample ID	Weathering	Shaliness	Fracturing	Stylolites	Pyrite	Calcite	$\bar{R}_o$	Error	Rank	Dip Elev		Card #
BB4144							.	.				1

0 8 10 12 14 16 18 20 24 28

Lab	Basis	Mst	Ash	Vol	BTU	Sulp	S.G.	FSI	
A	AR	.	.	.	.	.	.	.	2
L	AR	9.35	31.90	6.86	7206.	.18	.	.	3
L	AD	6.42	32.93	7.08	7439.	.19	1.64	.	4

1 3 8 13 18 23 27 31 33

North	East	Elev		5

8 16 22 71 7

Keypunch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data

Sample ID	Weathering	Shaliness	Fracturing	Structure	Pyrite	Calcite	$\bar{R}_o$	Error	Rank	Dep Env	Card #
TB4009							.	.			1

0 8 10 12 14 16 18 20 24 28

Lab	Basis	Mst	Ash	Vol	BTU	Sulp	S.G.	FSI	Card #
A	AR	.	.	.	.	.	.	.	2
L	AR	2.84	9.27	7.40	13570	.59	.	.	3
L	AD	1.16	9.43	7.53	13805	.60	1.41	0	4

1 3 8 13 18 23 27 31 33

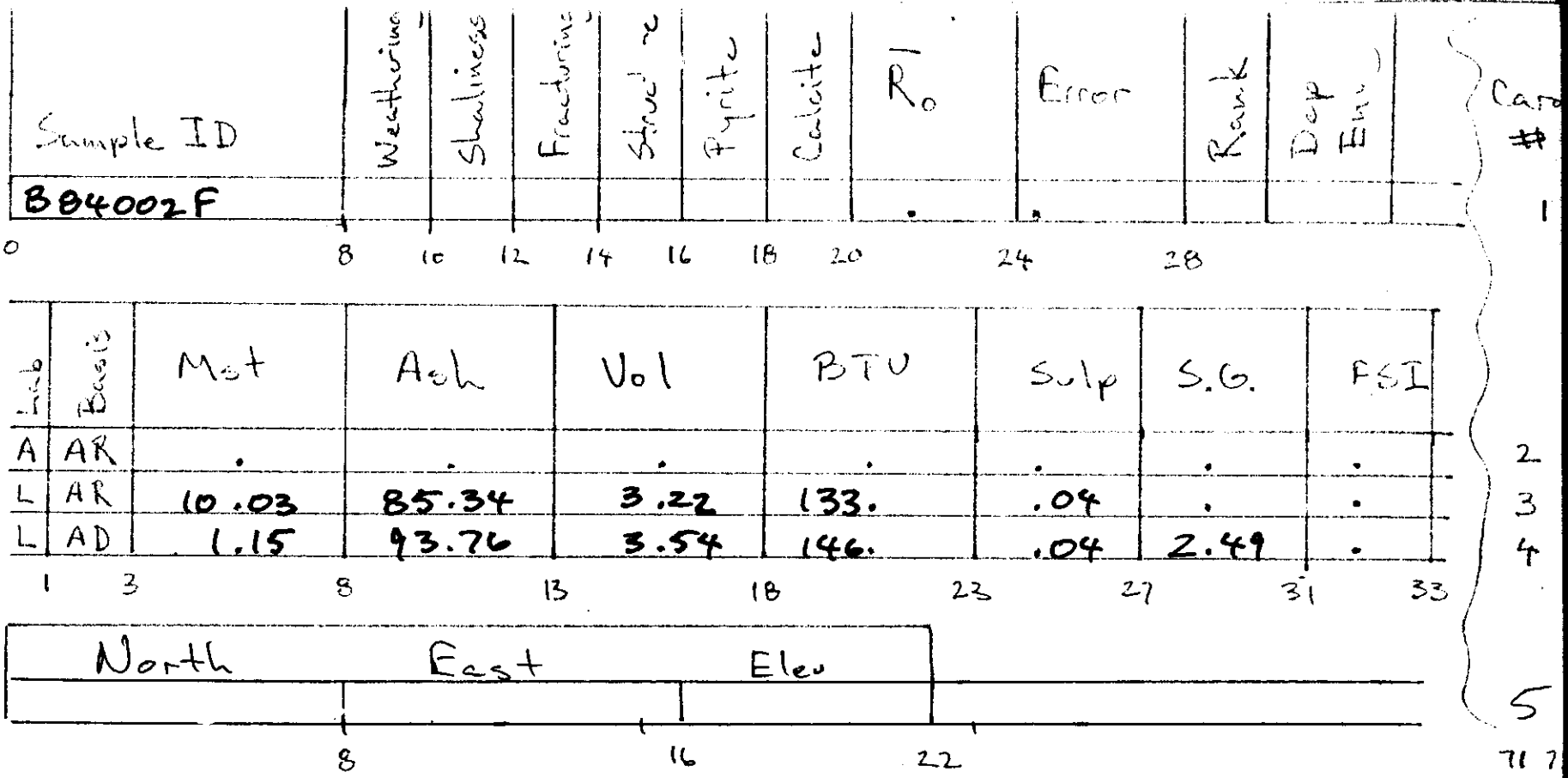
North	East	Elev	Card #
			5

8 16 22 71 72

Keypunch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data



Keypunch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data

Sample ID	Weathering	Shaliness	Fracturing	Structure	Pyrite	Calcite	$\bar{R}_o$	Error	Rank	Dep Env	Card #
B84002R							.	.			1

0 8 10 12 14 16 18 20 24 28

Lab	Basis	Mst	Ash	Vol	BTU	Sulp	S.G.	FSI	
A	AR	.	.	.	.	.	.	.	2
L	AR	4.74	80.89	4.88	1387.	.07	.	.	3
L	AD	1.56	83.59	5.04	1433.	.07	2.30	.	4

1 3 8 13 18 23 27 31 33

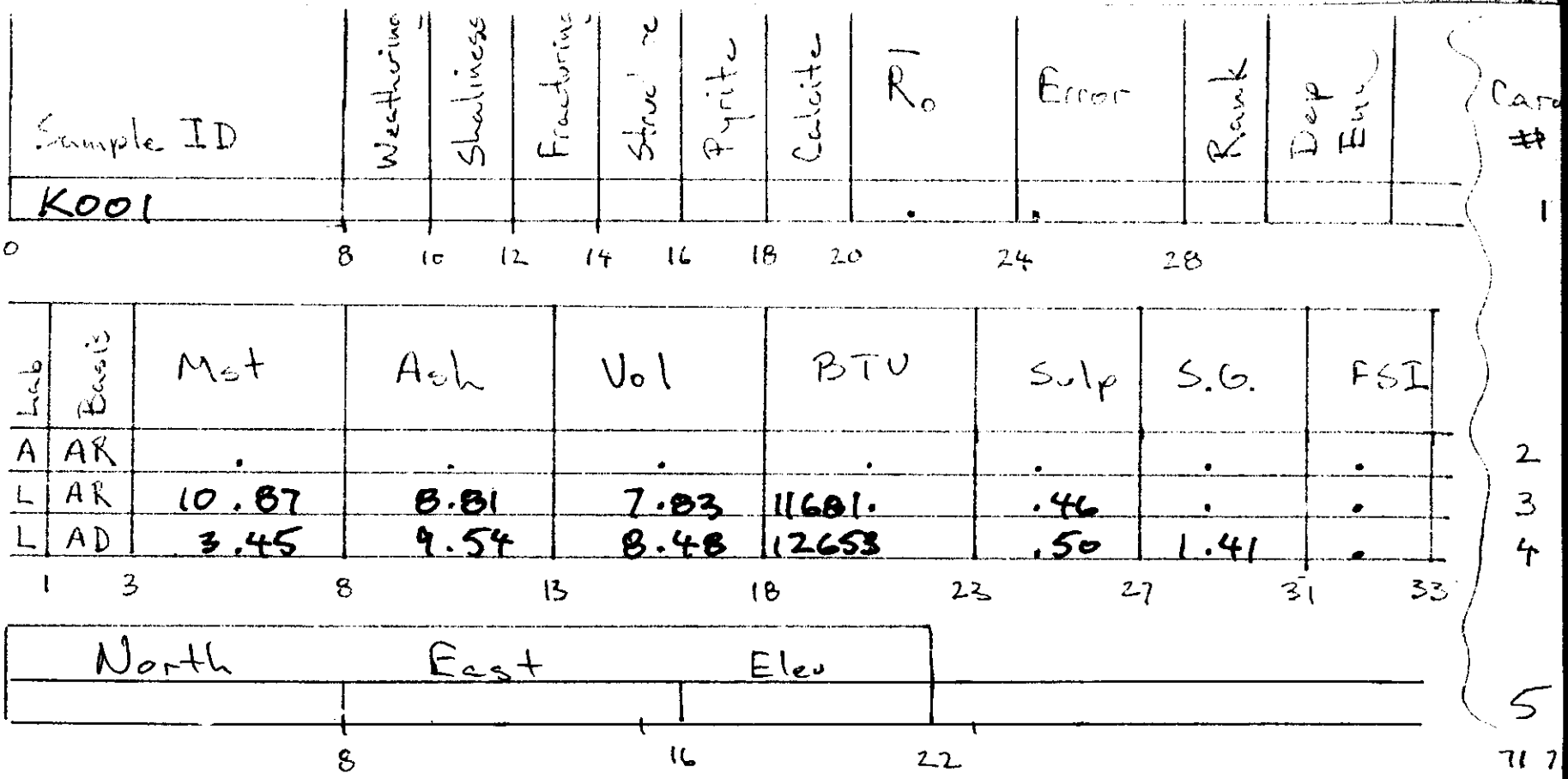
North	East	Elev	5

8 16 22 71 7

Keypunch

5 cards per observation (Sample ID)

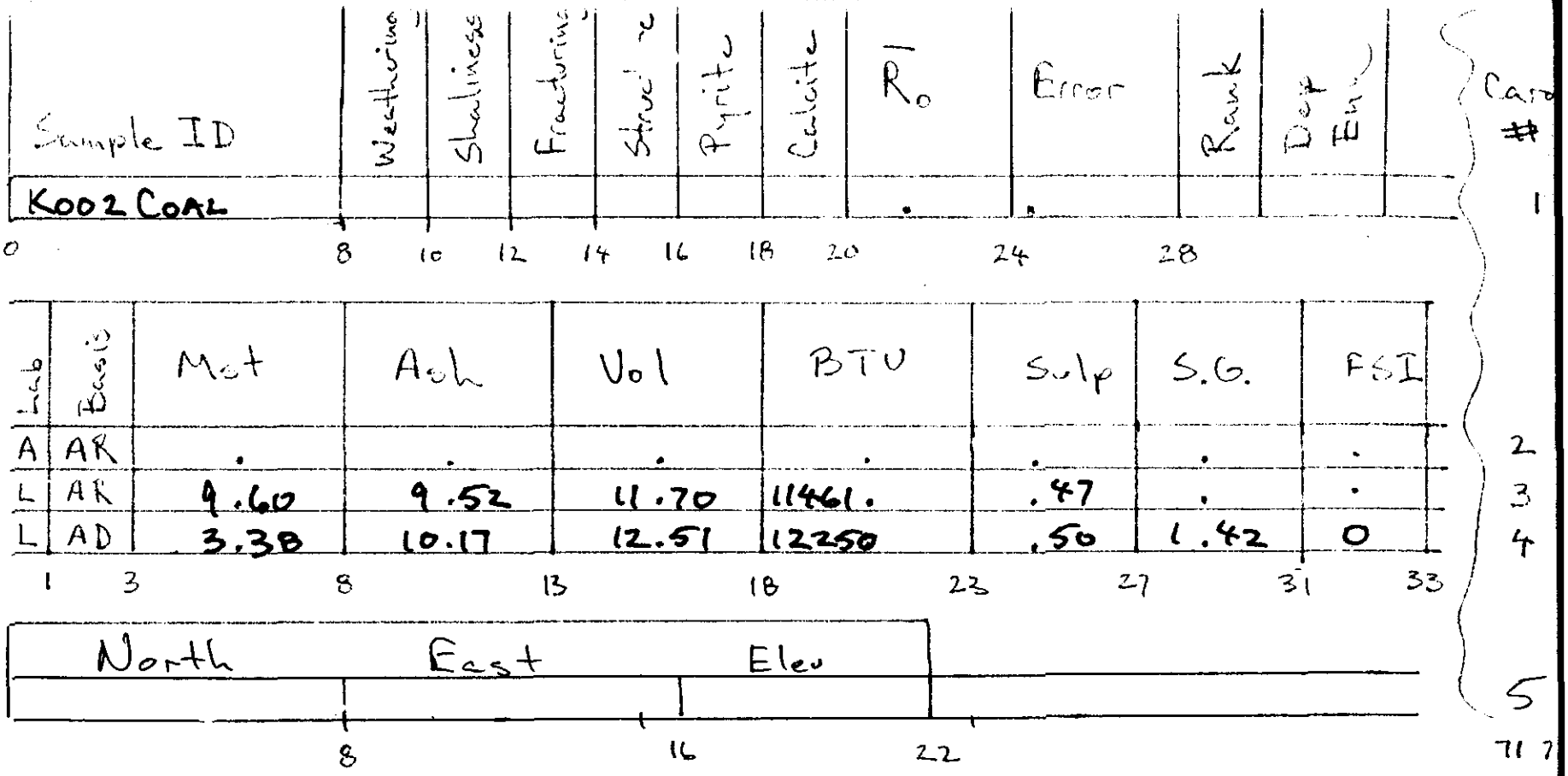
include '.'s as these indicate missing data



Keypunch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data



Keypunch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data

Sample ID	Weathering	Shaliness	Fracturing	Struct ν	Pyrite	Calcite	$\bar{R}_o$	Error	Rank	Dep Ht	Card #
K002 FL							.	.			1

0 8 10 12 14 16 18 20 24 28

Lab	Basis	Mst	Ash	Vol	BTU	Sulp	S.G.	FSI	
A	AR	.	.	.	.	.	.	.	2
L	AR	11.13	53.37	9.19	4478.	.27	.	.	3
L	AD	2.53	58.53	10.08	4582.	.30	1.94	.	4

1 3 8 13 18 23 27 31 33

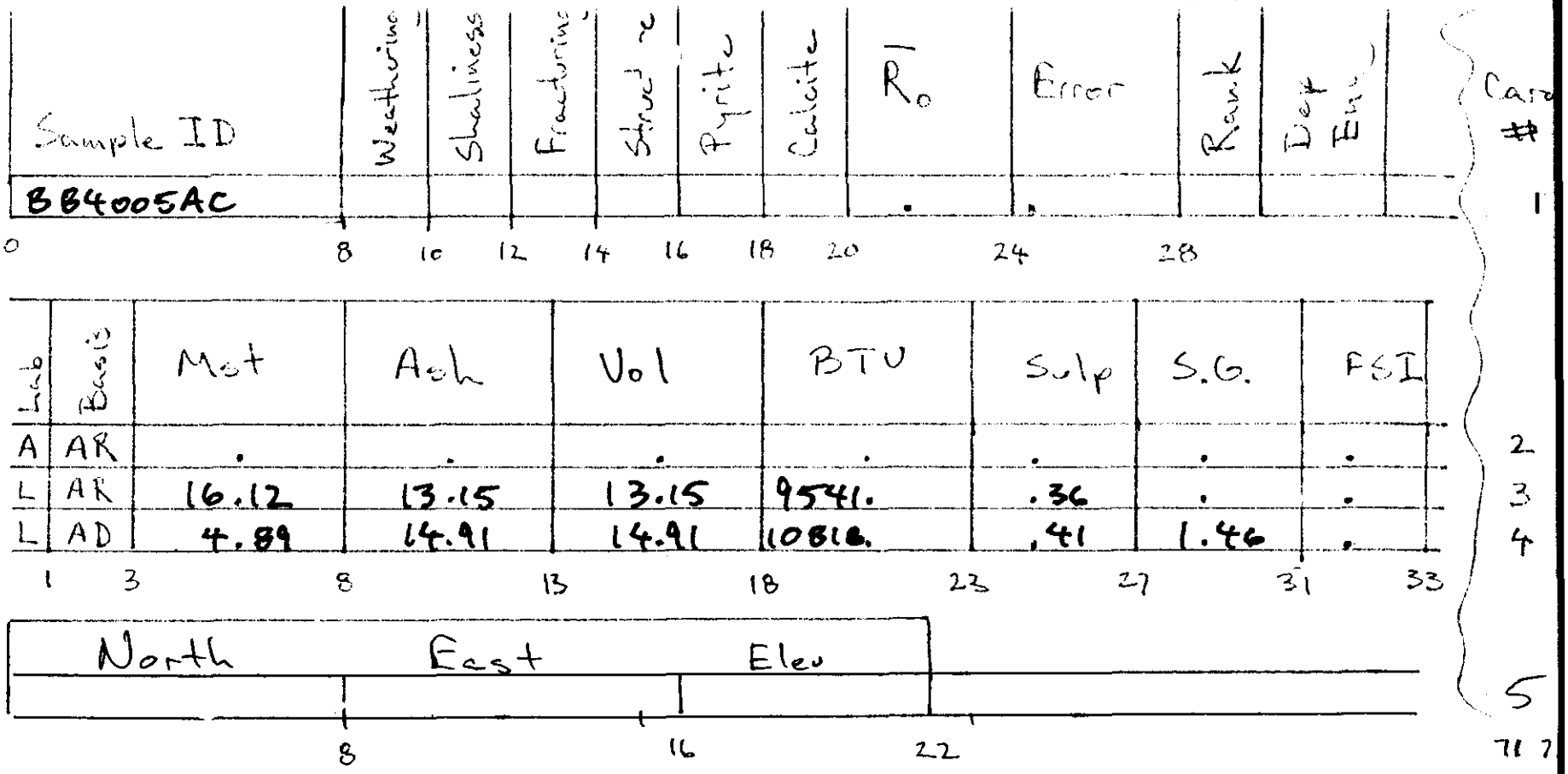
North	East	Elev	5

8 16 22 71 7

Keypunch

5 cards per observation (Sample ID)

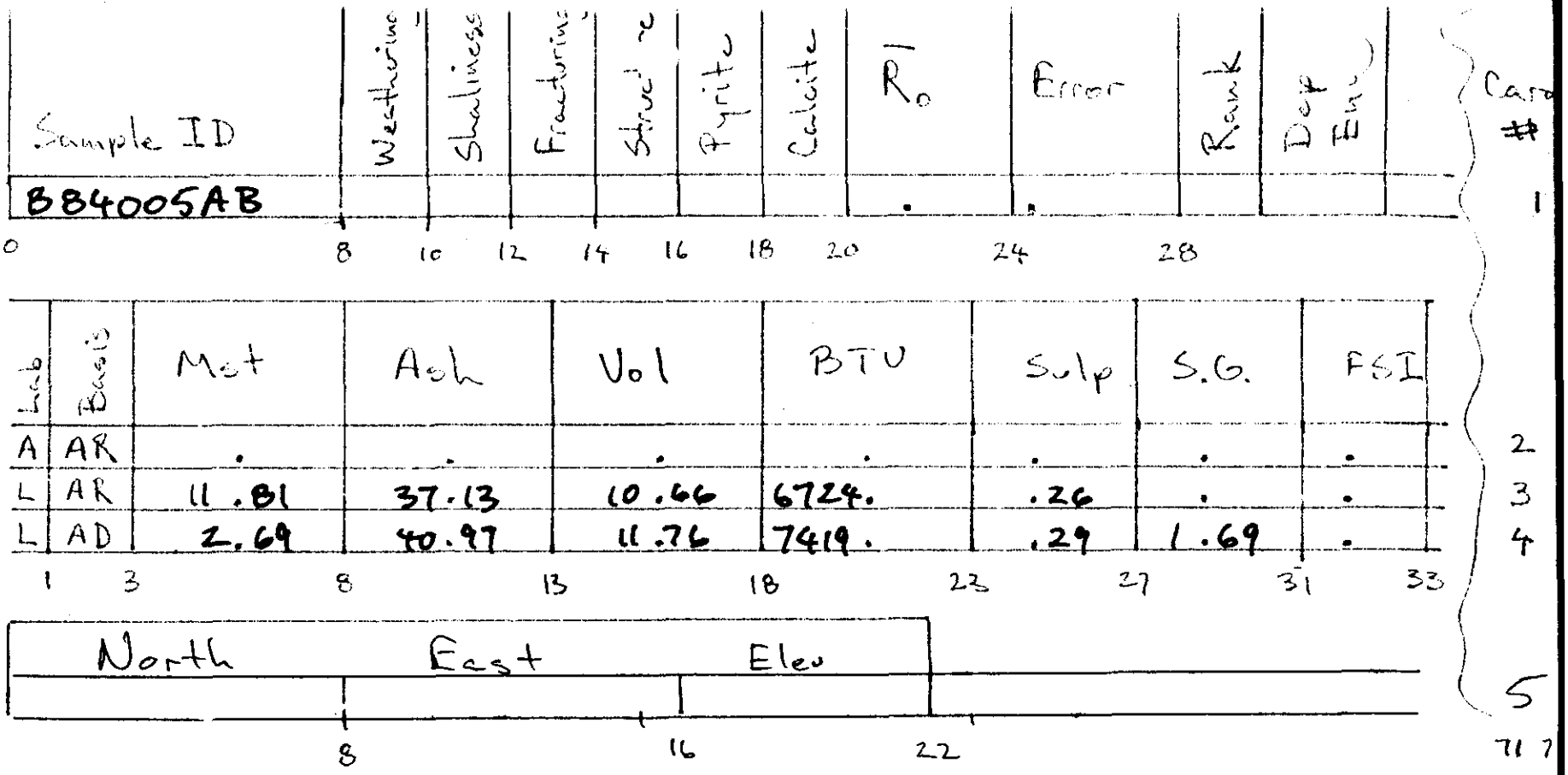
include '.'s as these indicate missing data



Keypunch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data



Keypunch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data

Sample ID	Weathering	Shaliness	Fracturing	Structure	Pyrite	Calcite	$\bar{R}_o$	Error	Rank	Dep Env	Card #
B84005AA							.	.			1

0 8 10 12 14 16 18 20 24 28

Lab	Basis	Mst	Ash	Vol	BTU	Sulp	S.G.	FSI	Card #
A	AR	.	.	.	.	.	.	.	2
L	AR	12.34	27.20	12.37	8280.	.30	.	.	3
L	AD	4.70	29.57	13.45	9002.	.33	1.62	.	4

1 3 8 13 18 23 27 31 33

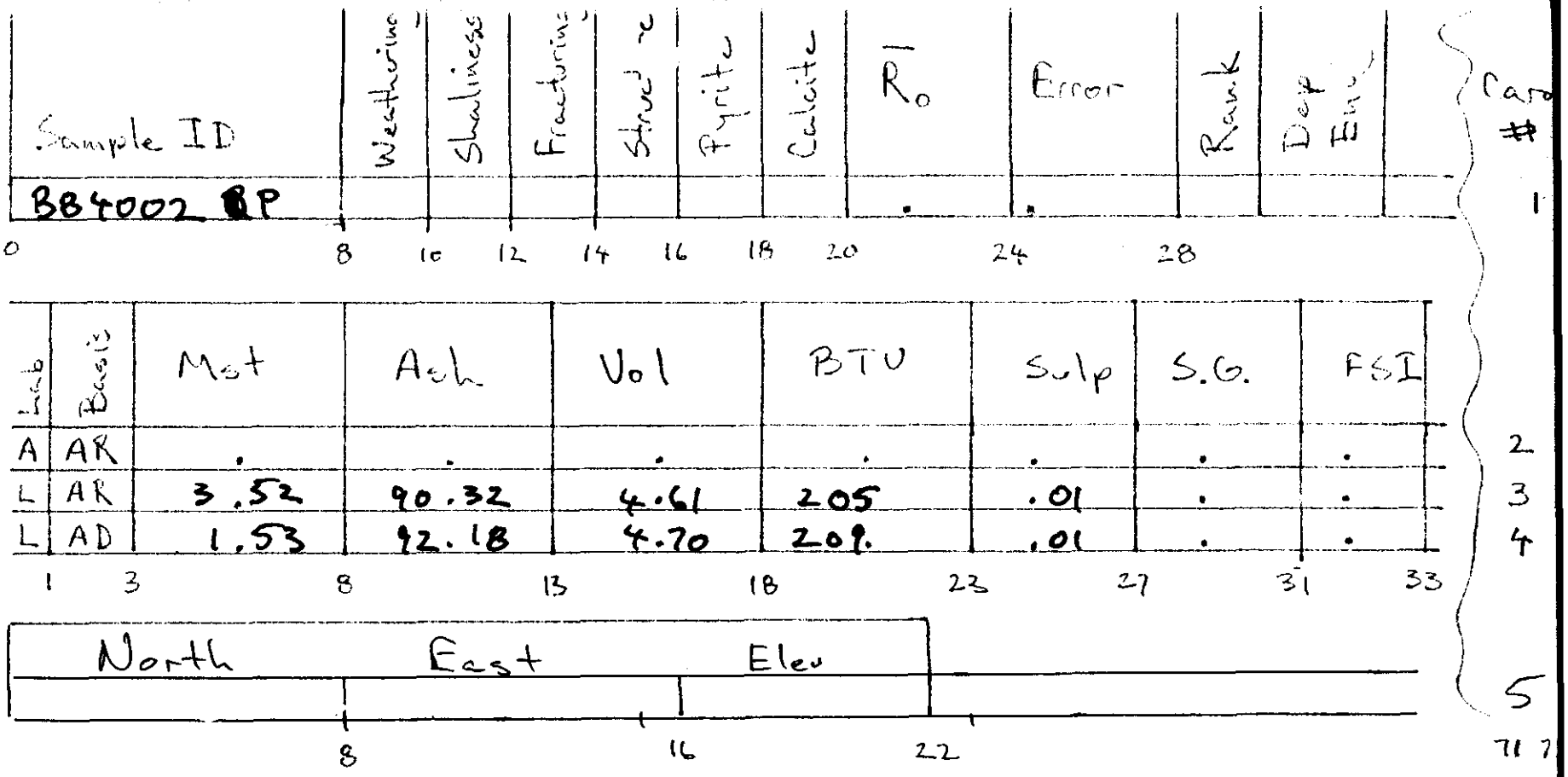
North	East	Elev	Card #
			5

8 16 22 71 7

Keypunch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data



Keypunch

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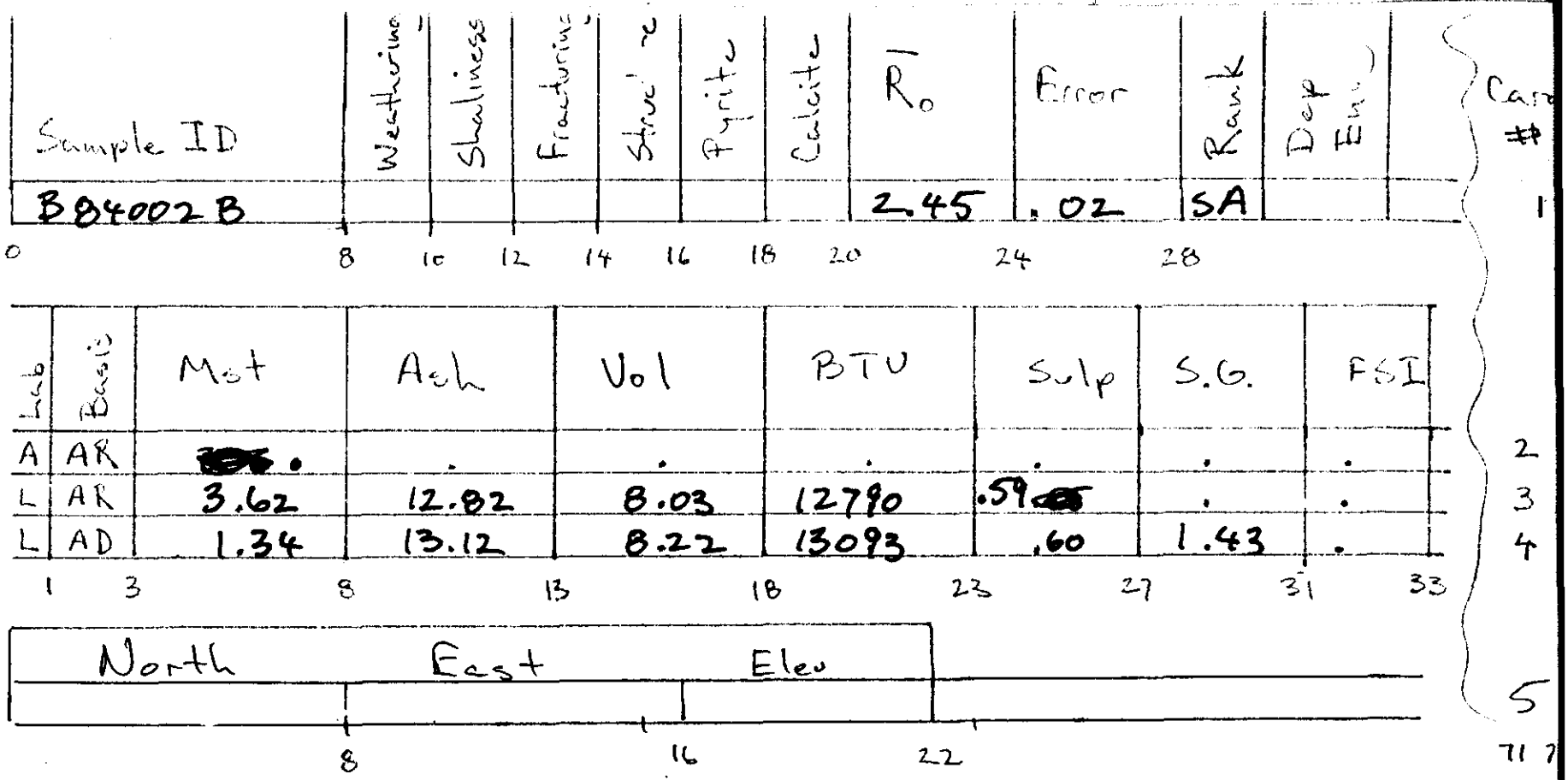

Keypunch

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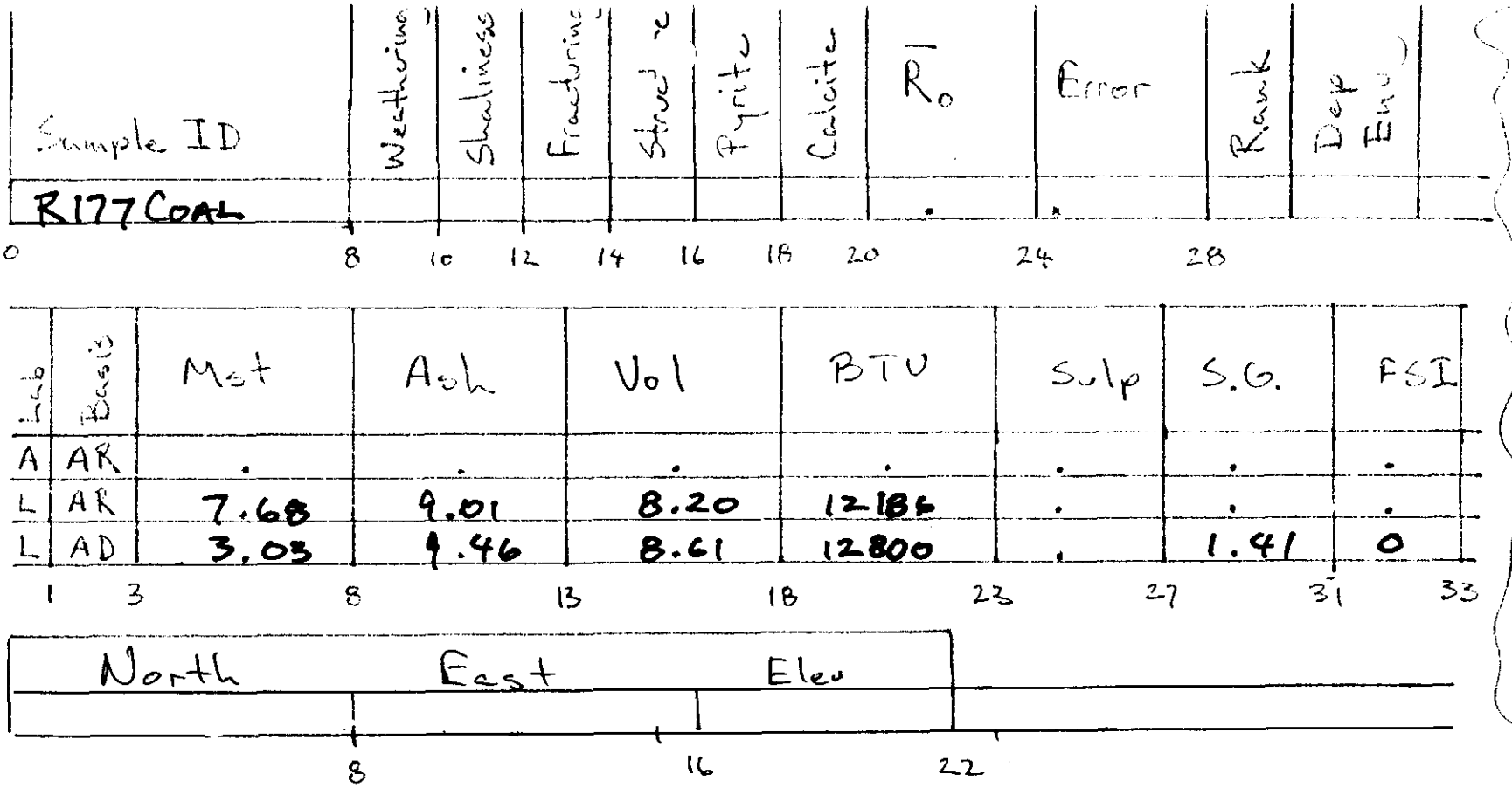

Key punch

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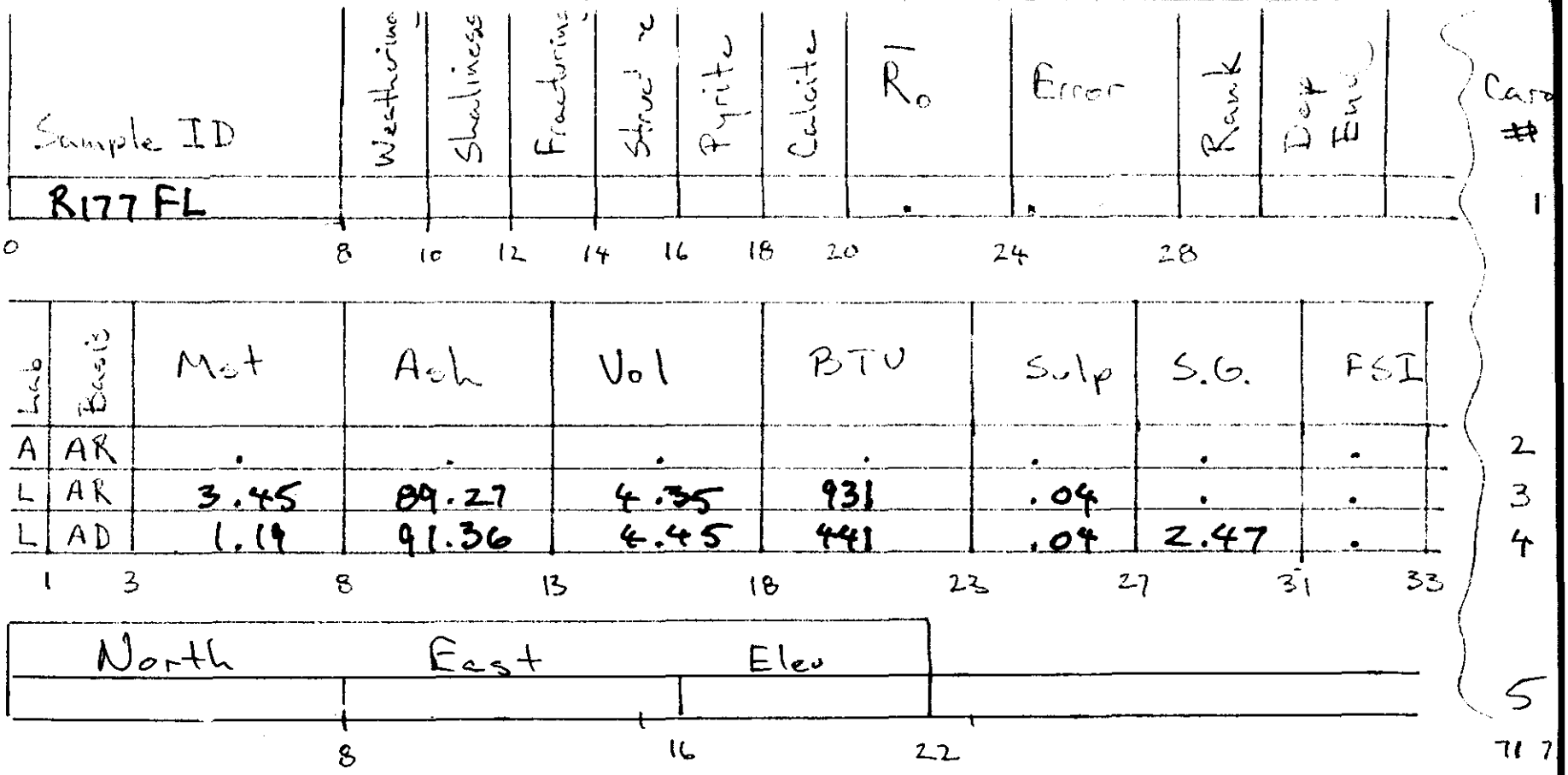

Keypunch

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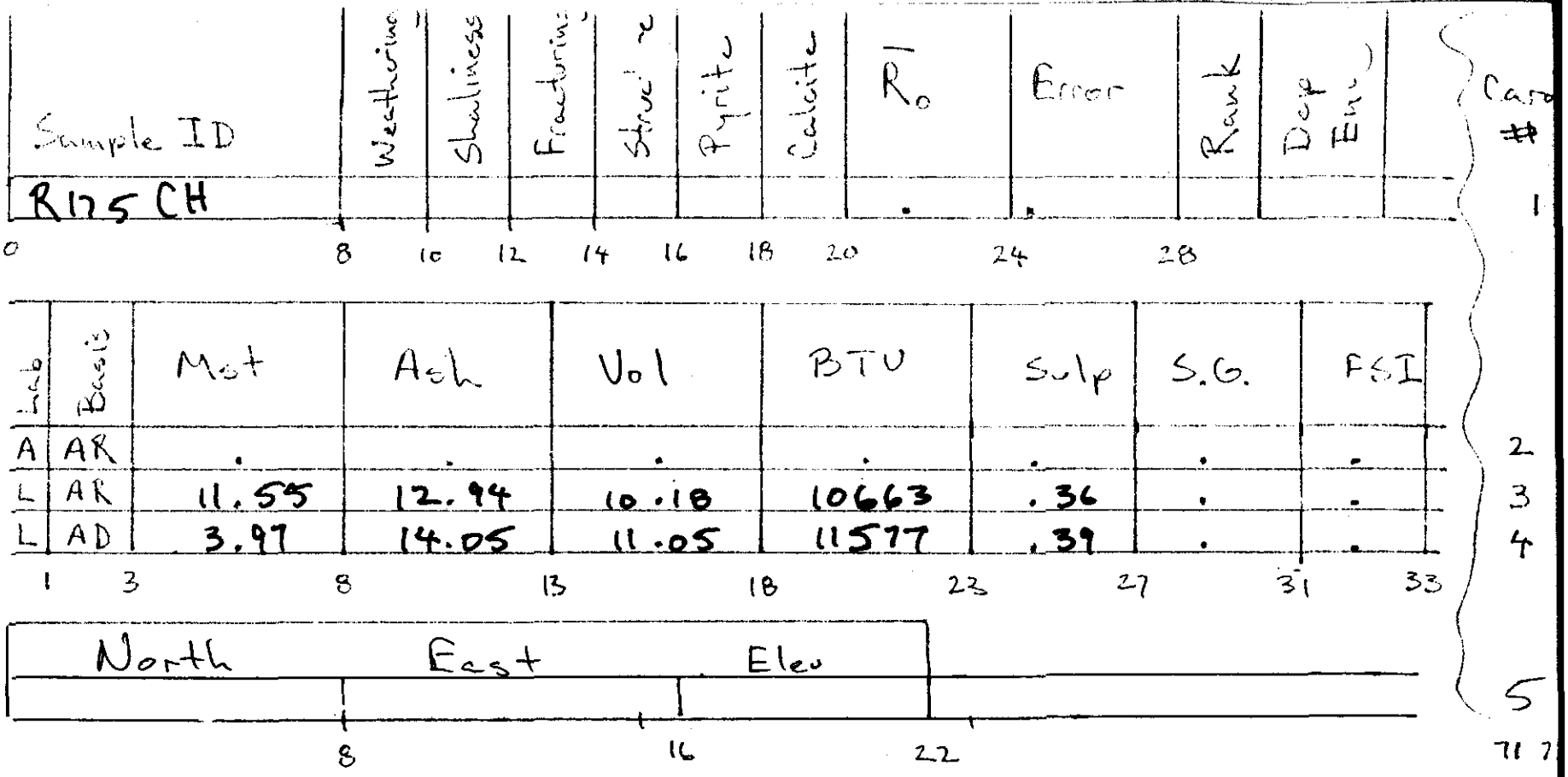

Keypunch

5 cards per observation (Sample ID)

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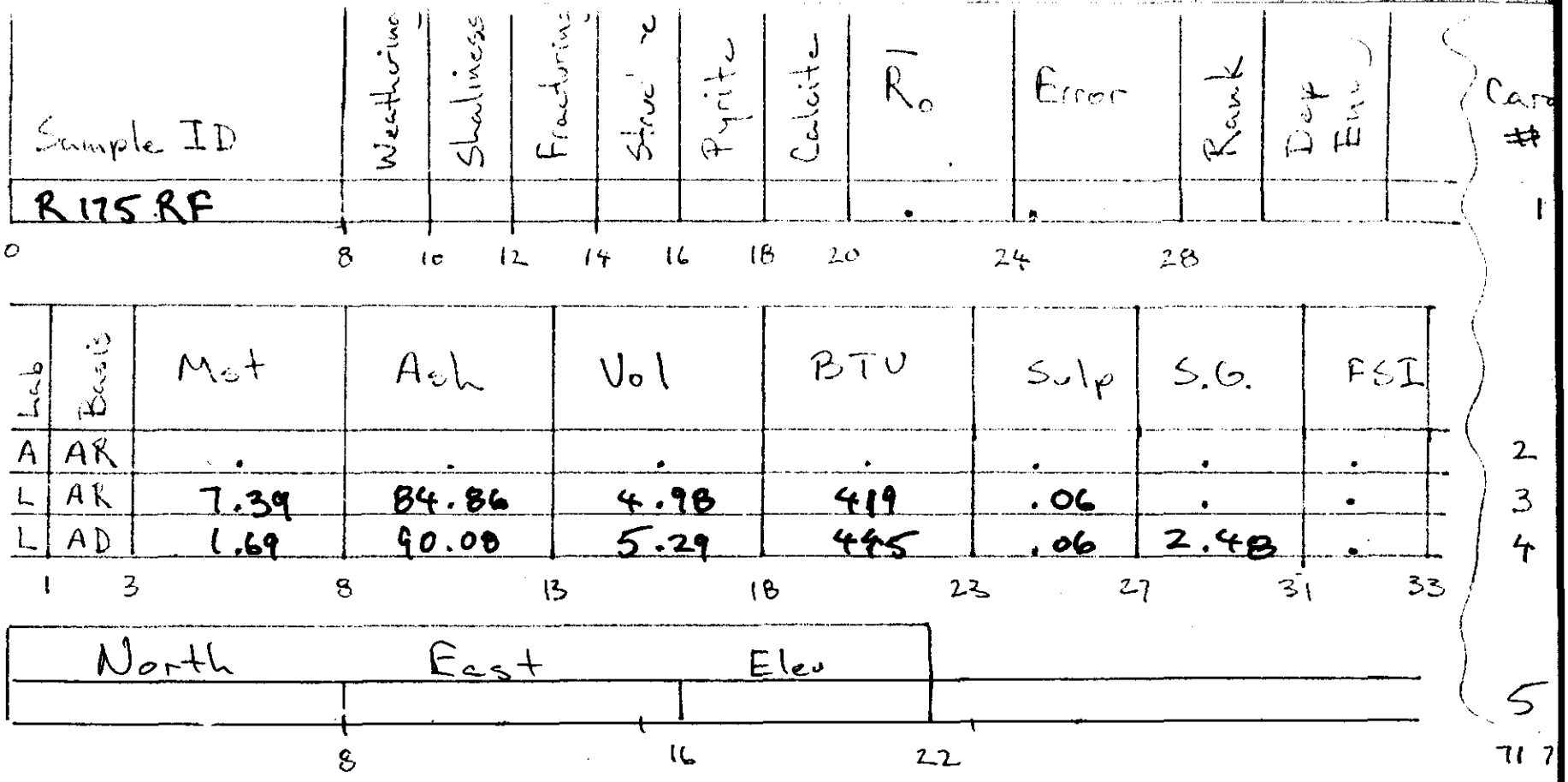

Keypunch

5 cards per observation (Sample ID)

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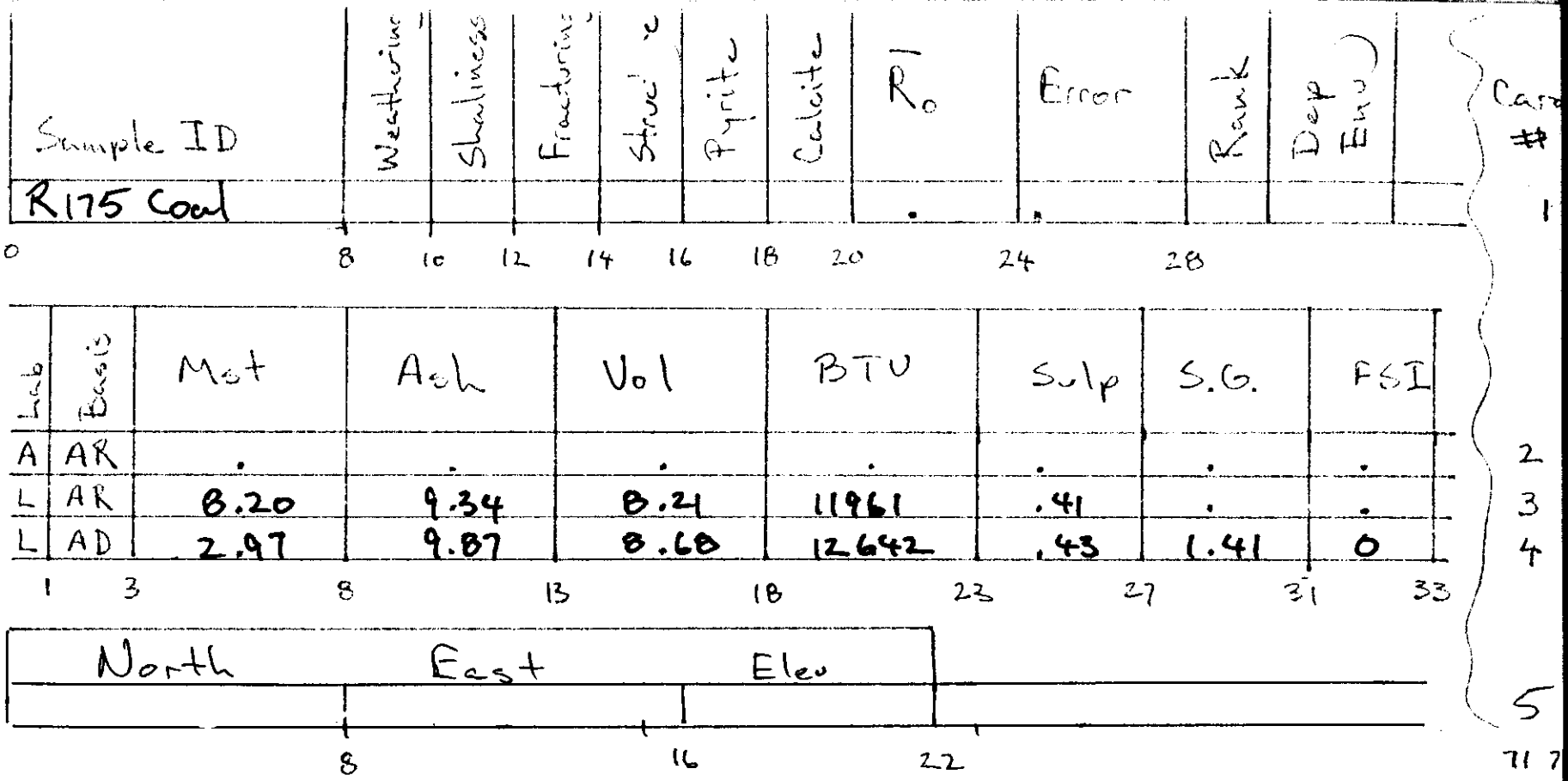

Keypunch

5 cards per observation (Sample ID)

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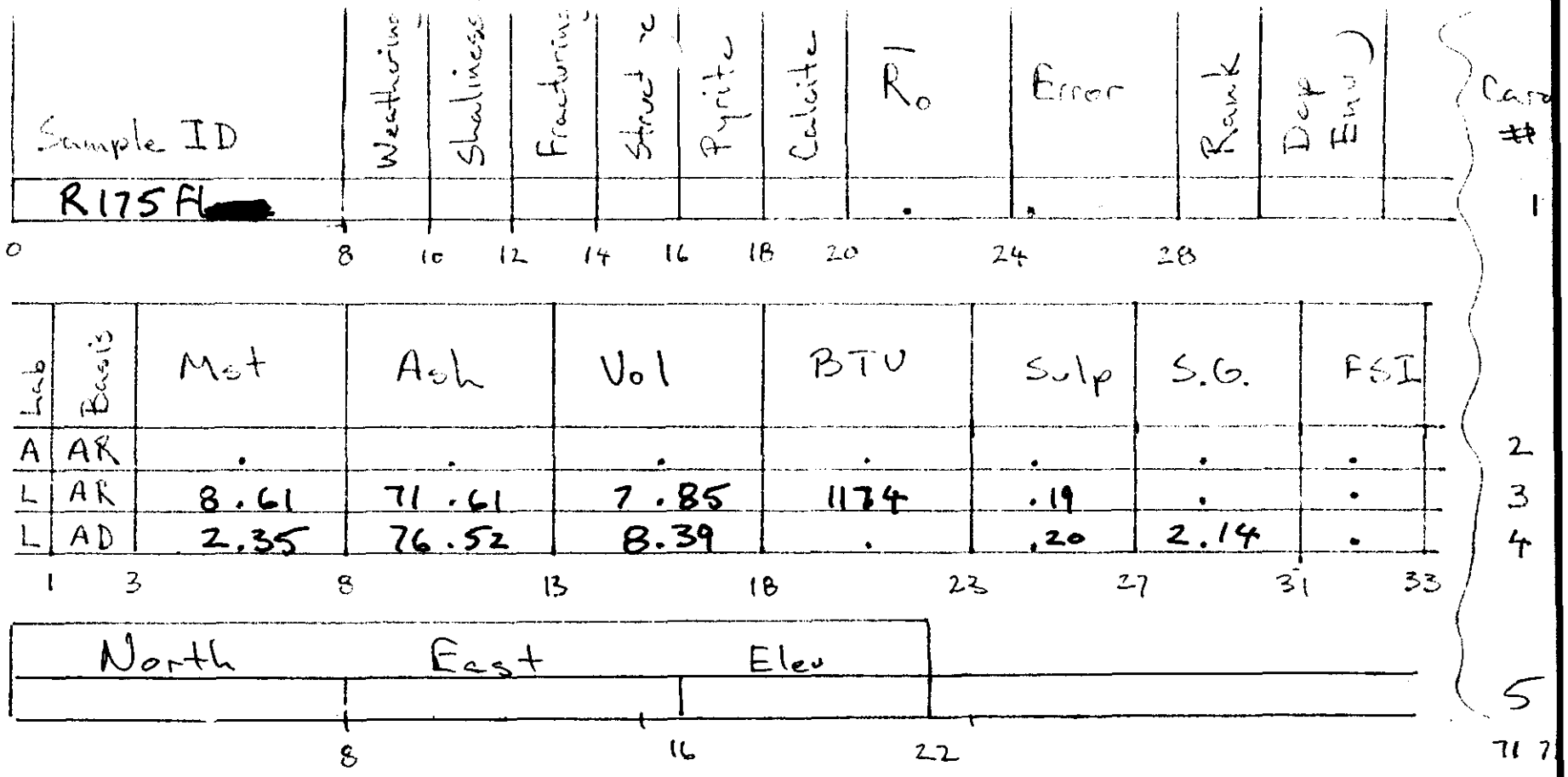

Keypunch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data

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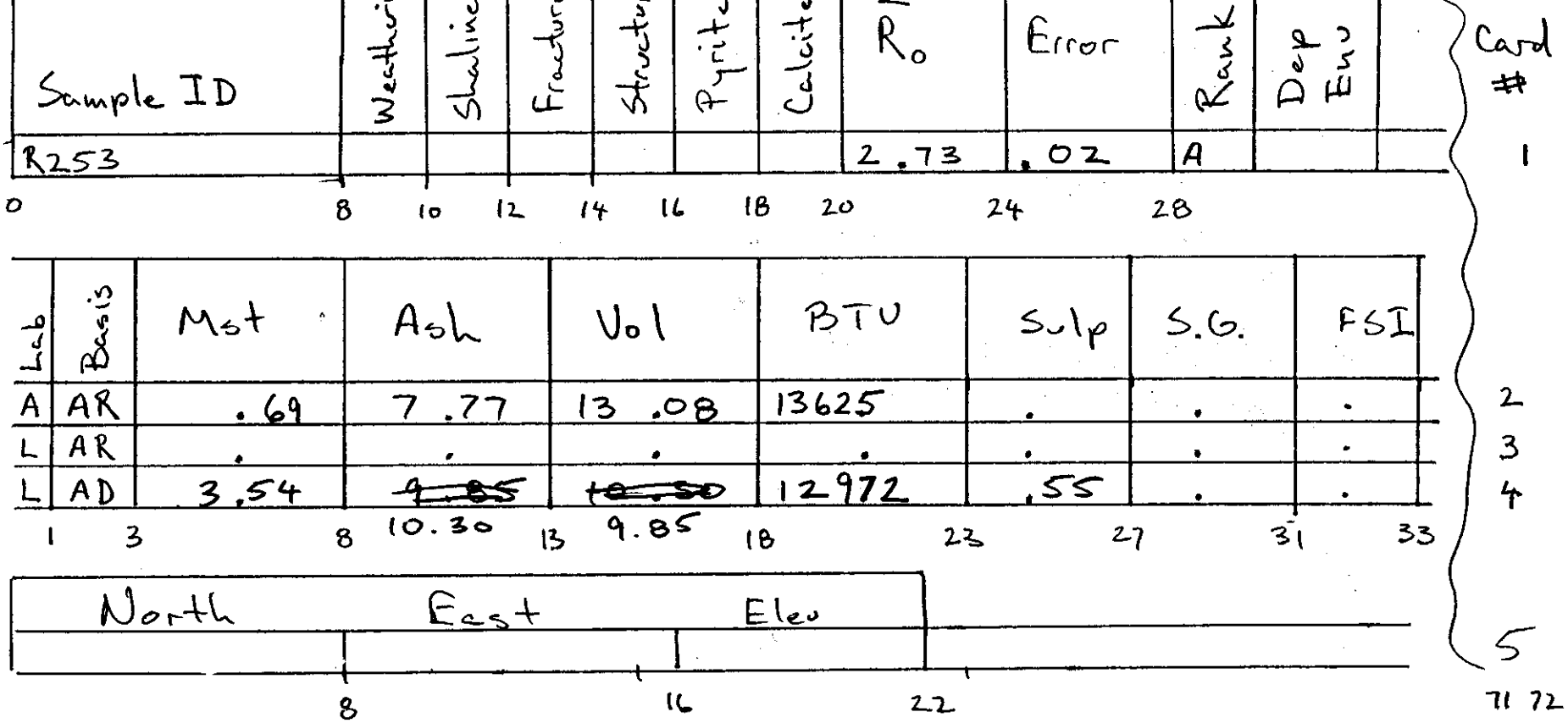

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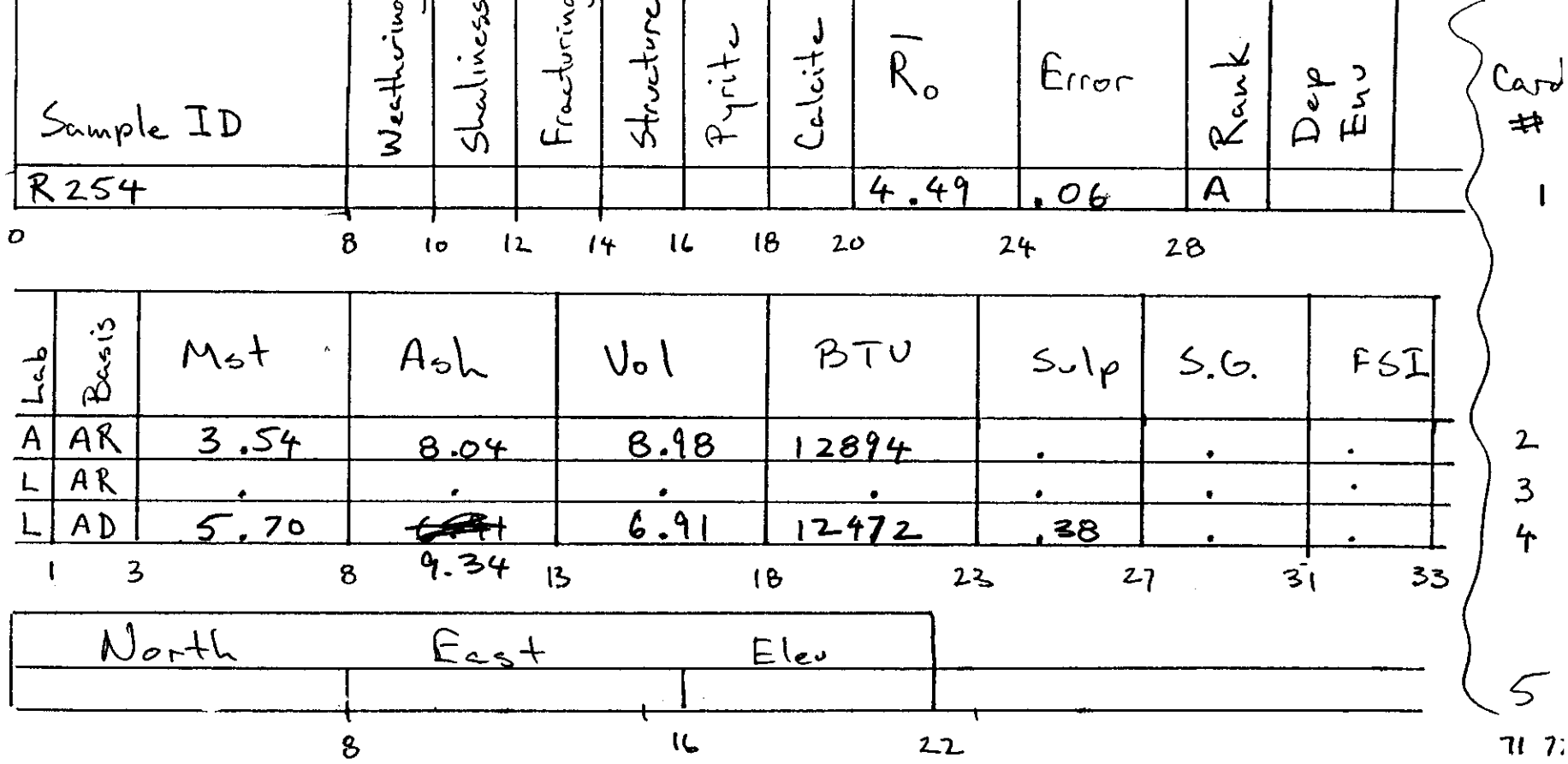

Keypunch

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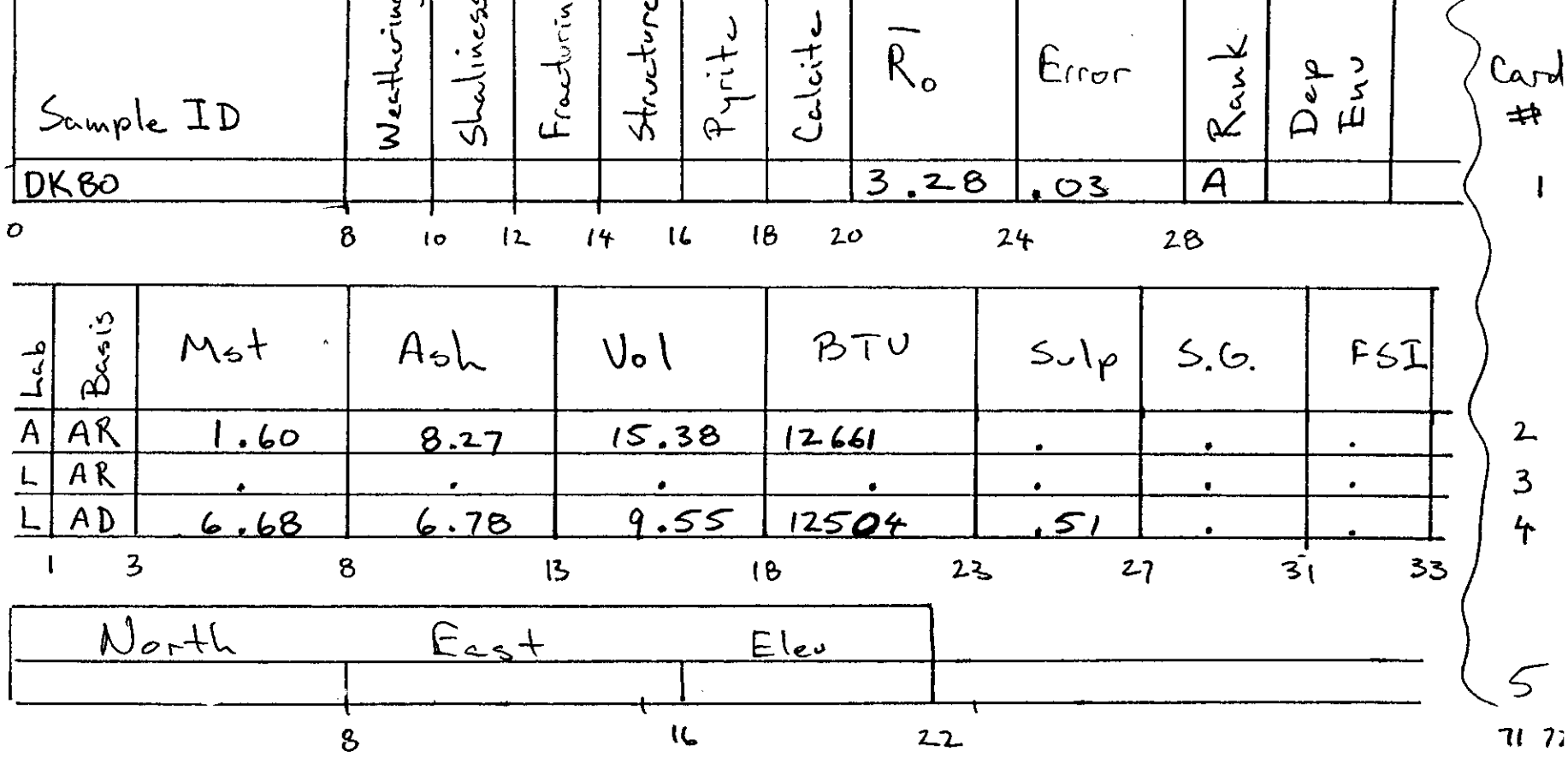

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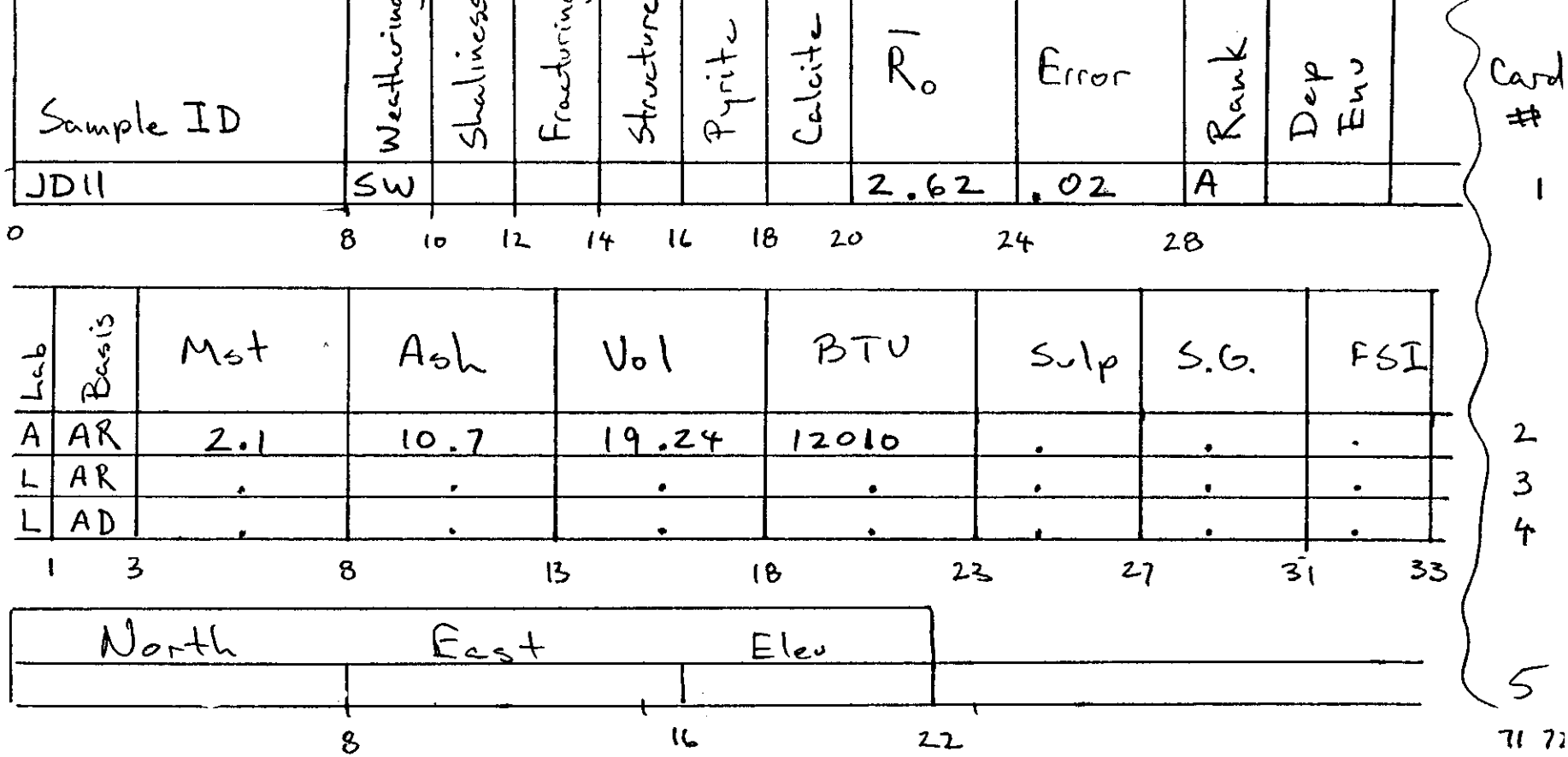

Keypunch

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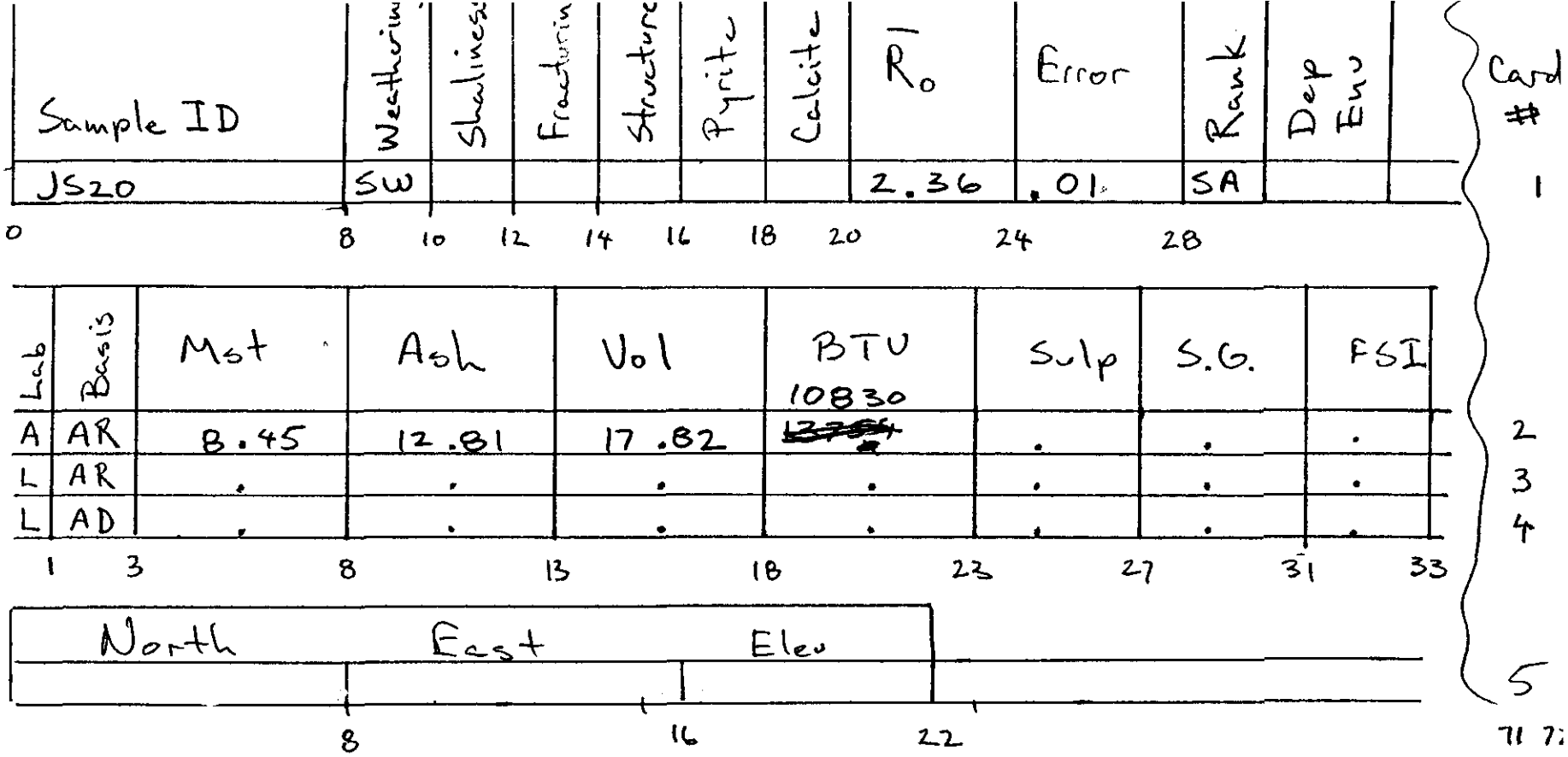

Keypunch

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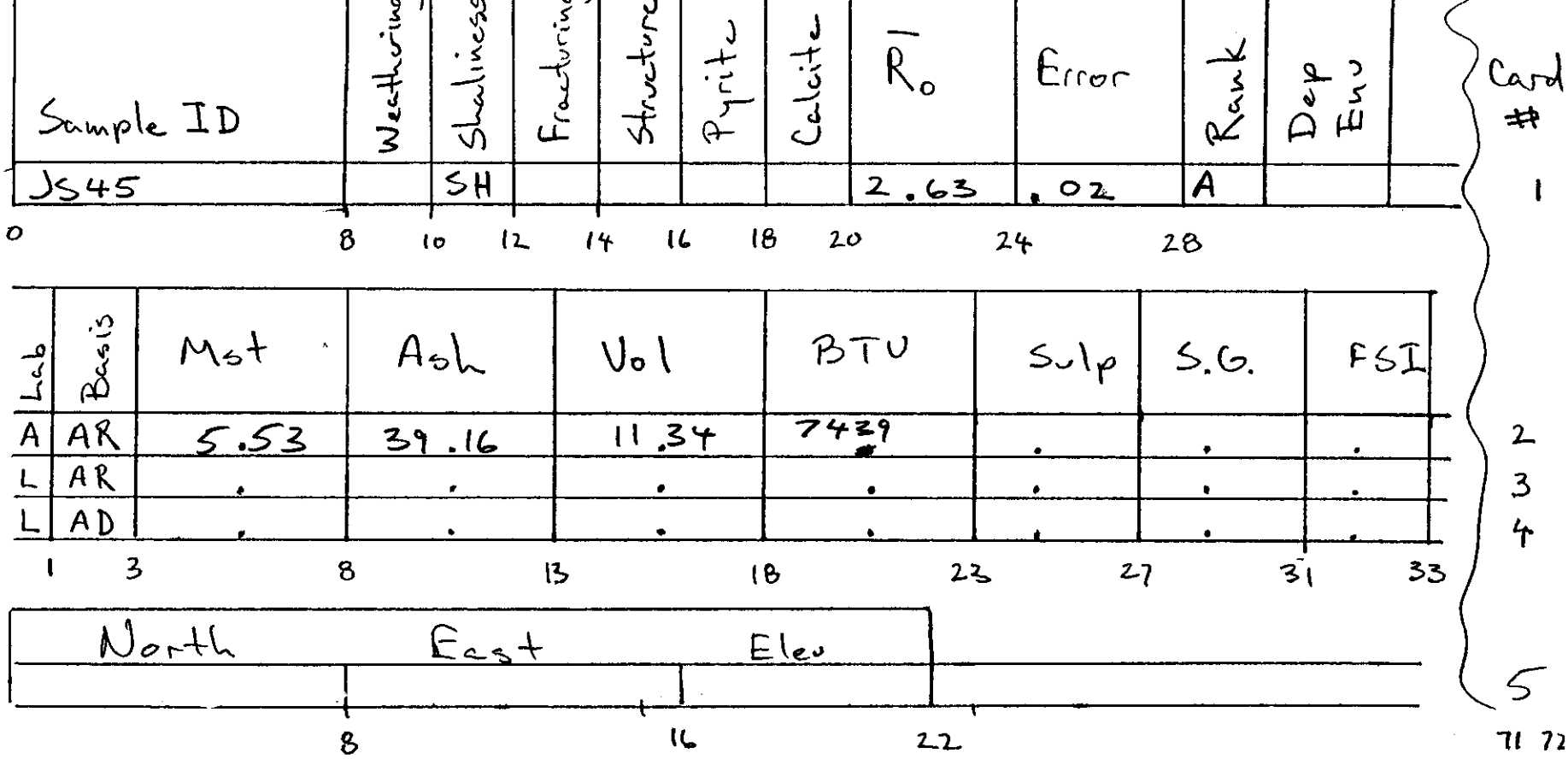

Keypunch

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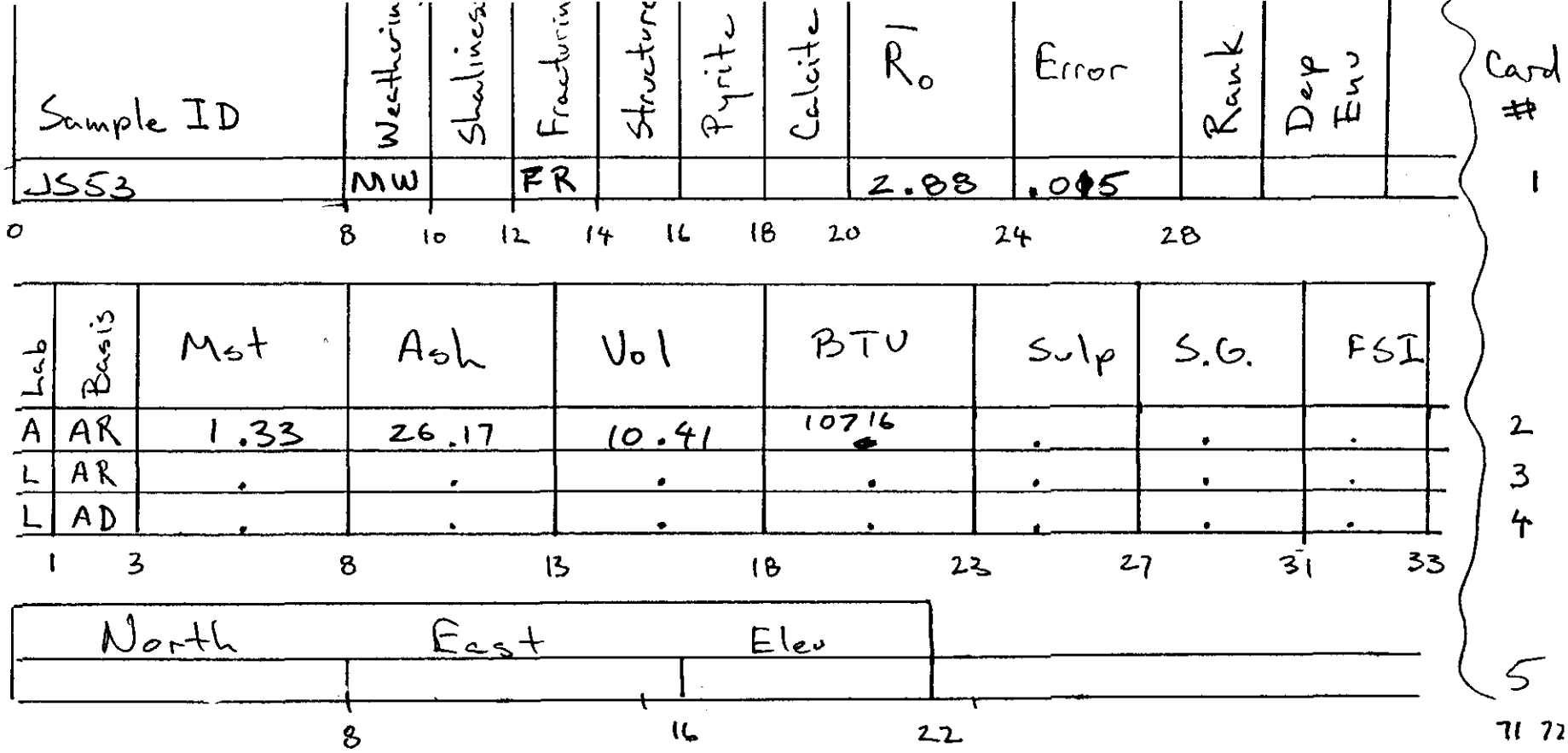

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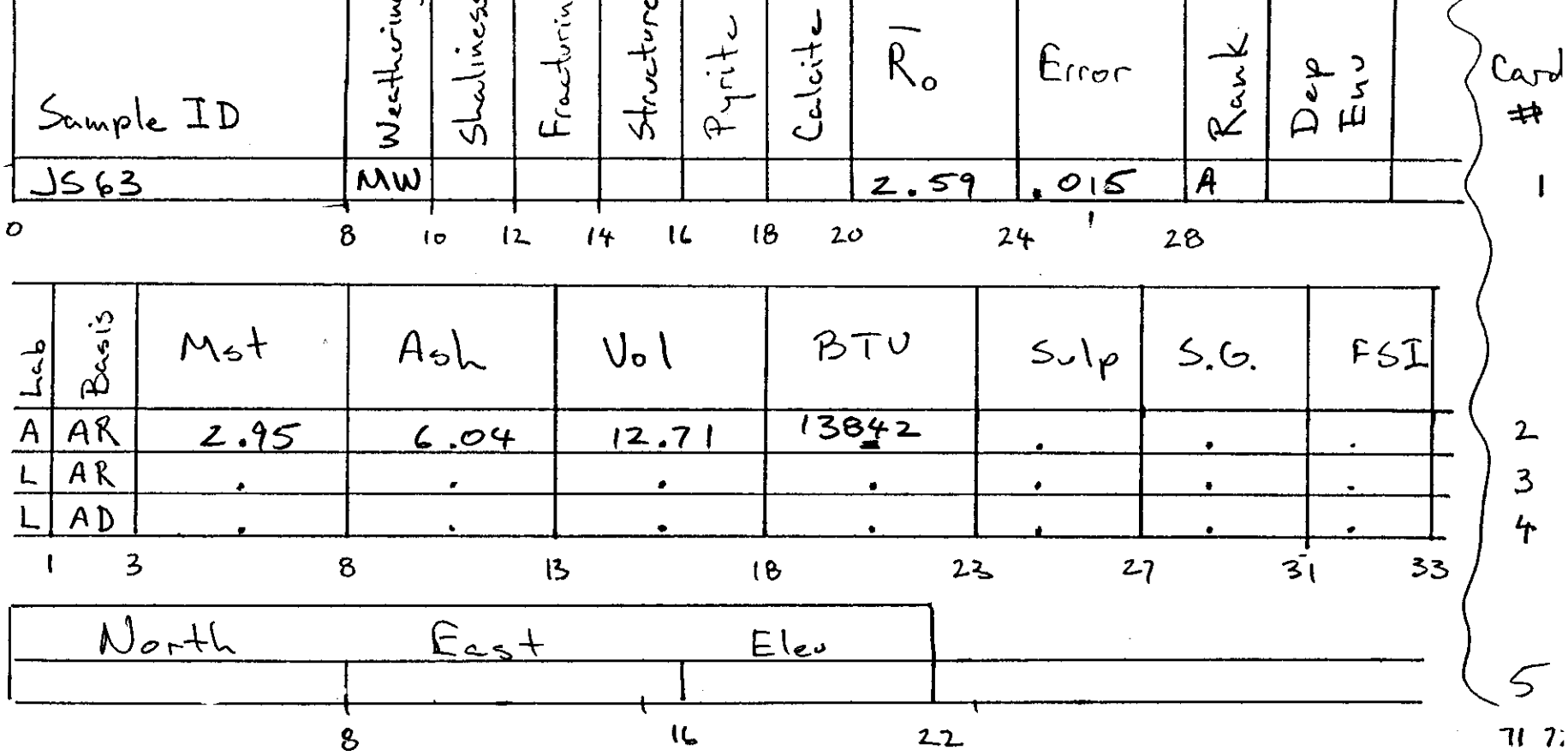

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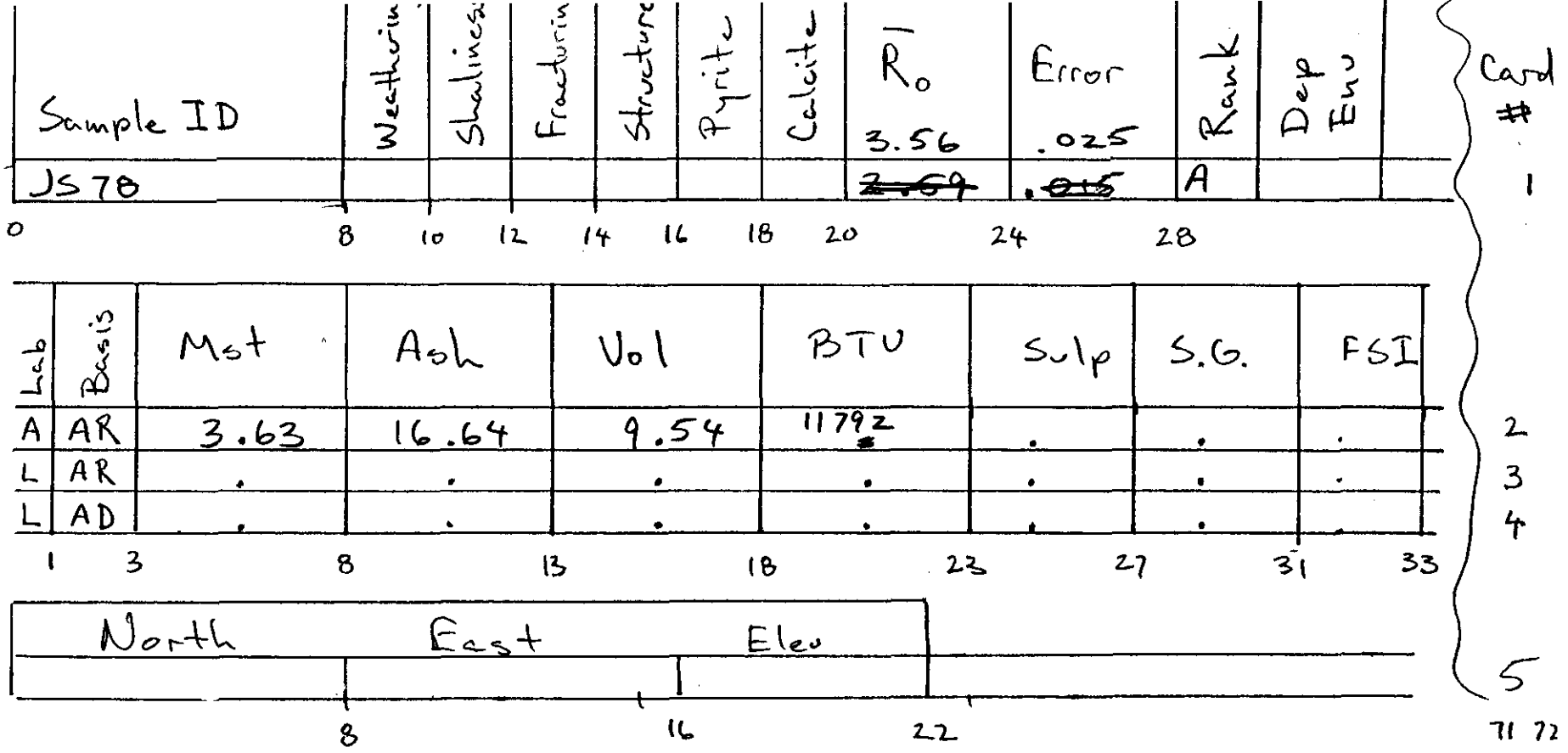

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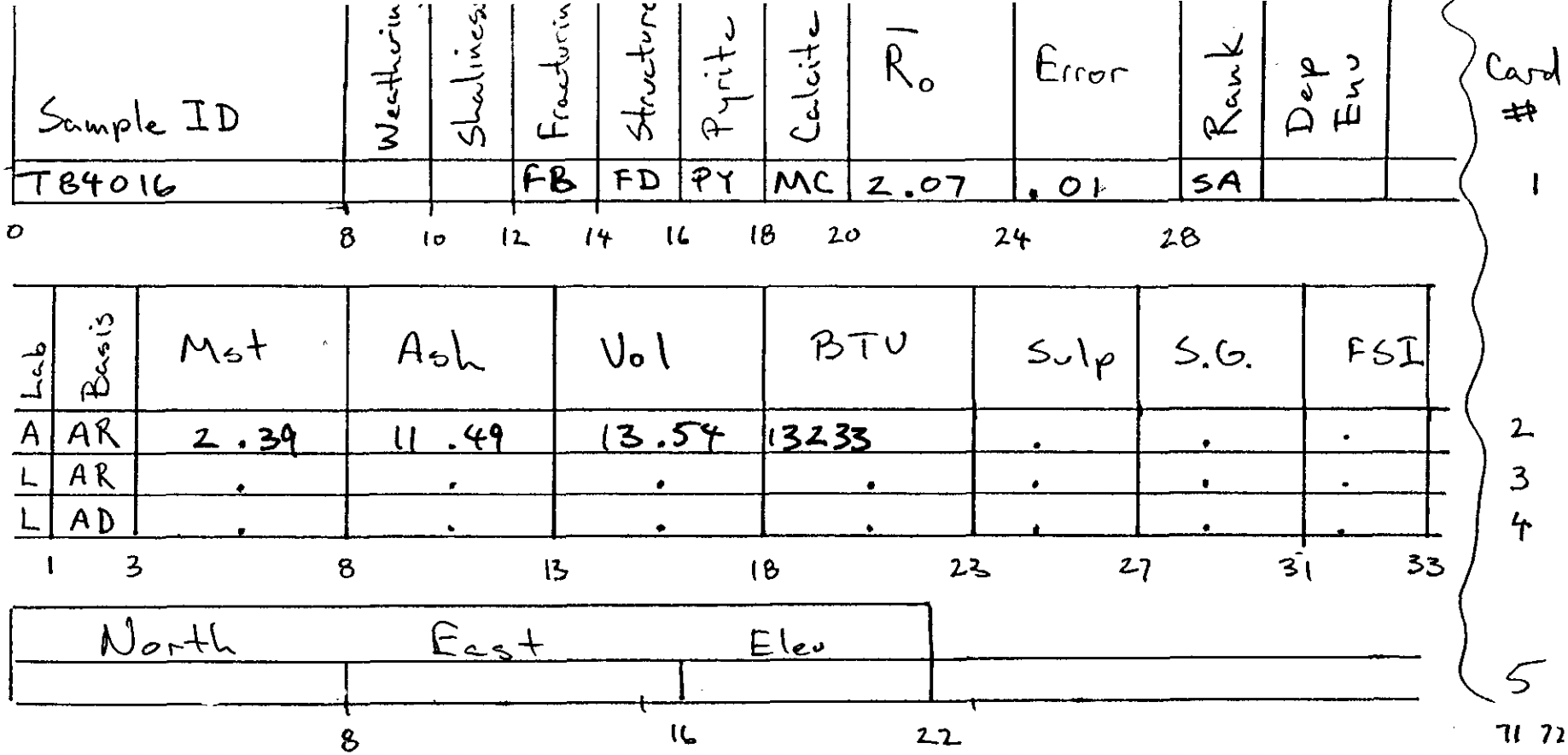

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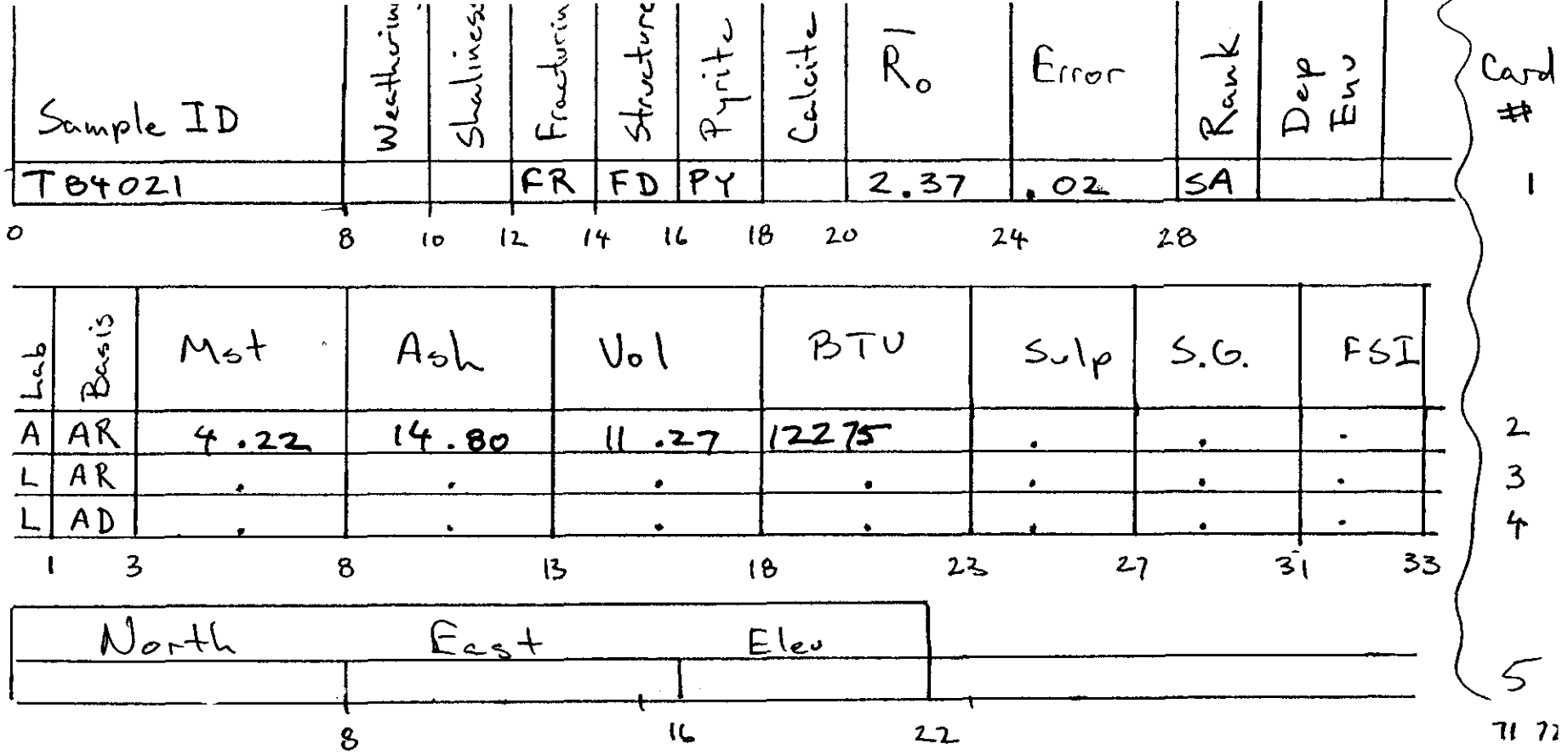

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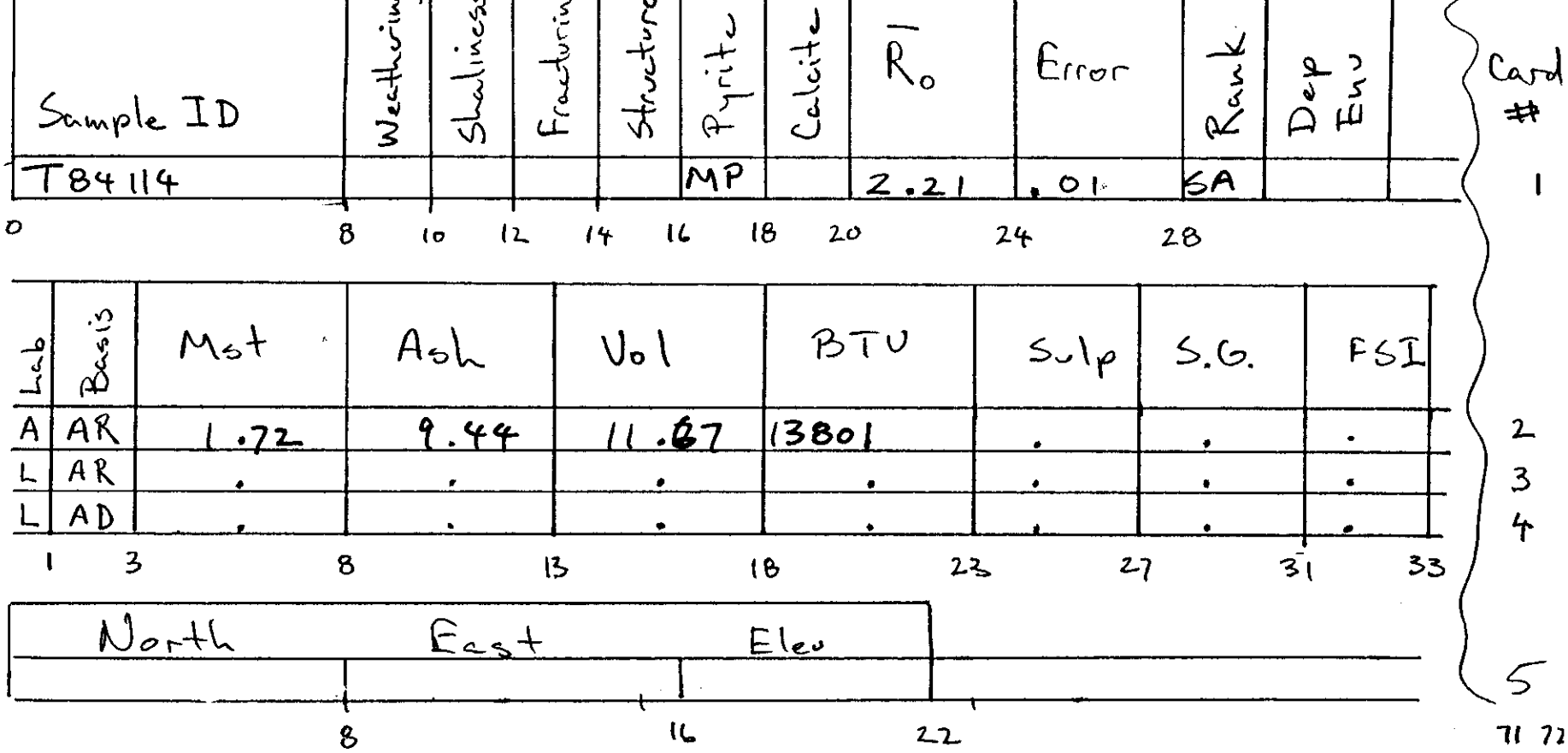

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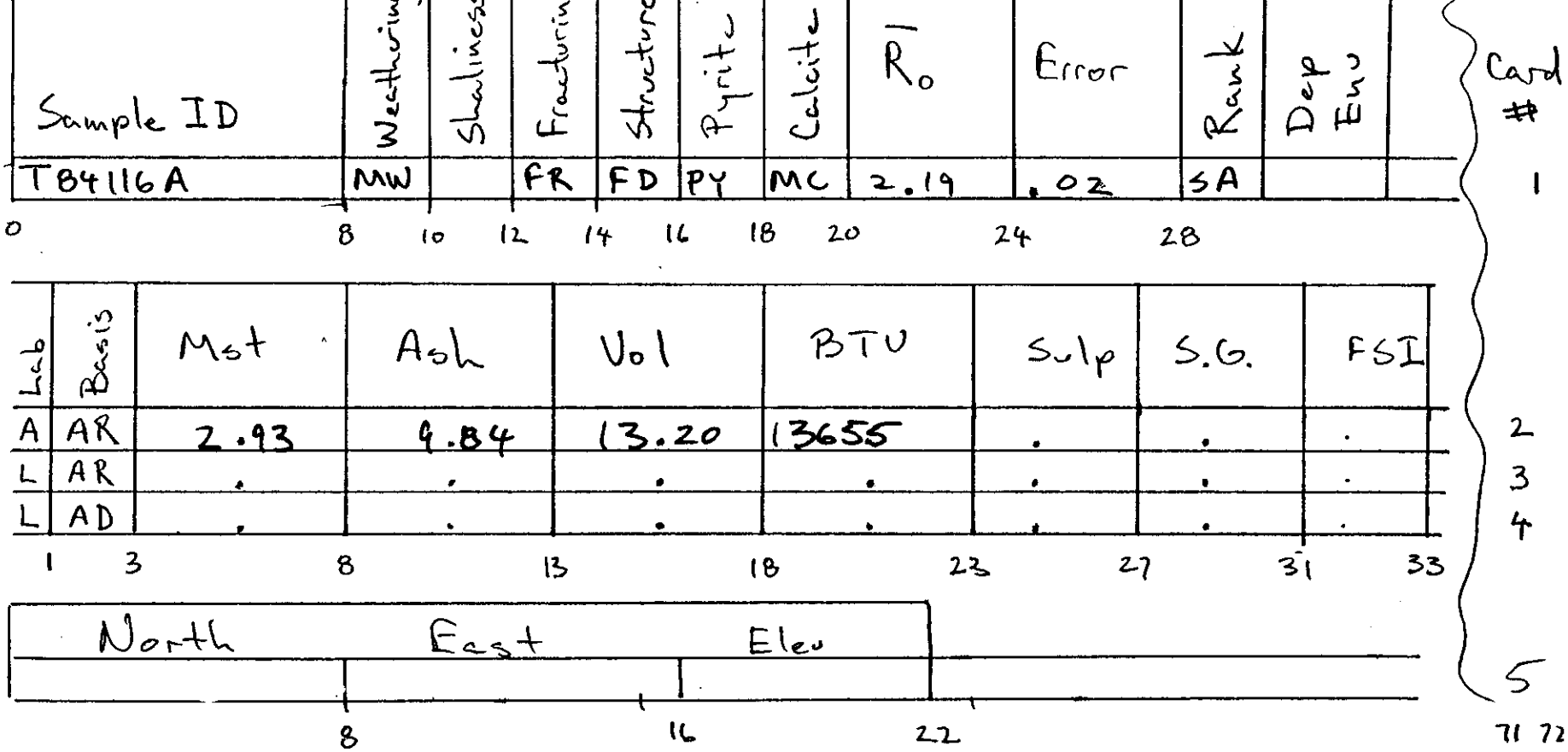

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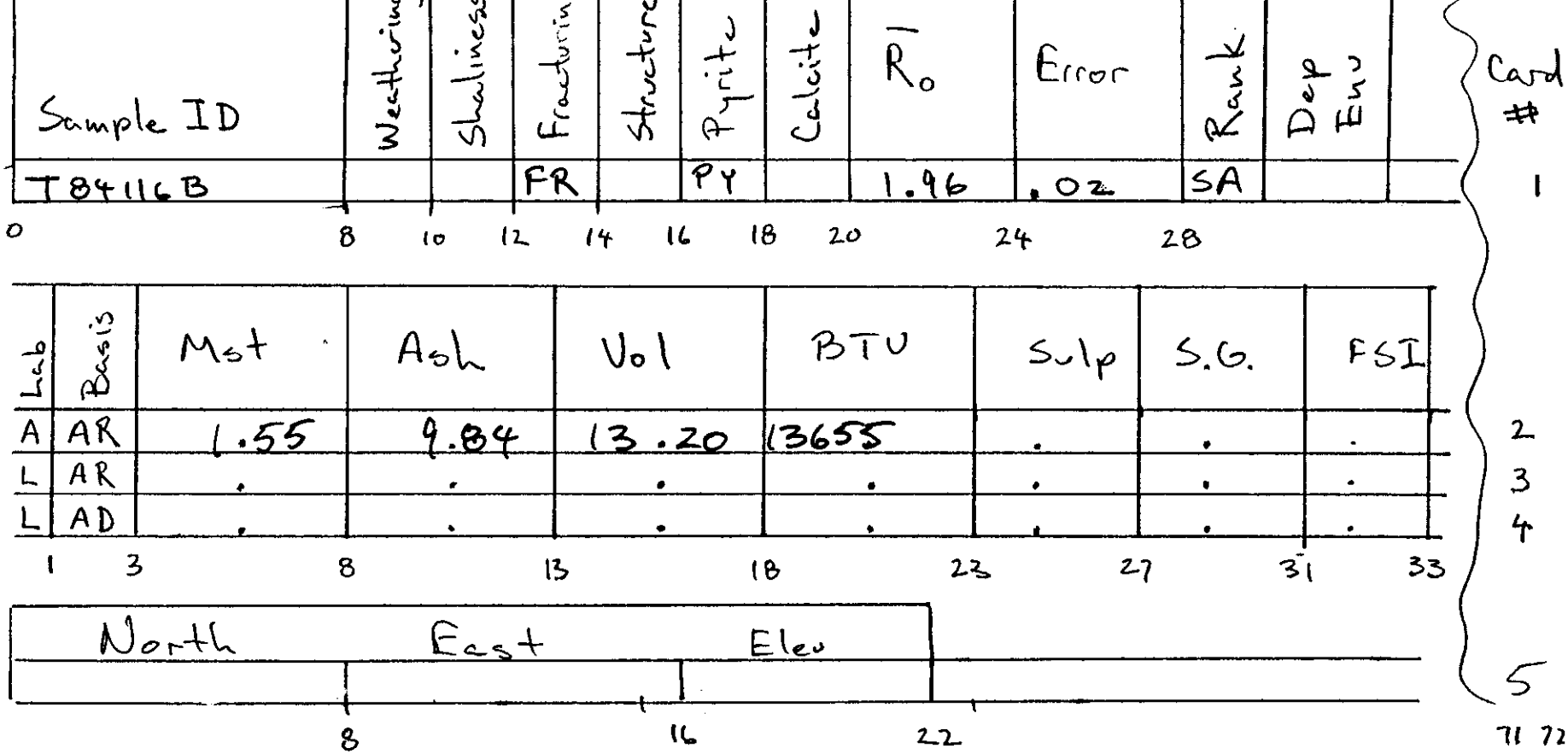

Keypunch

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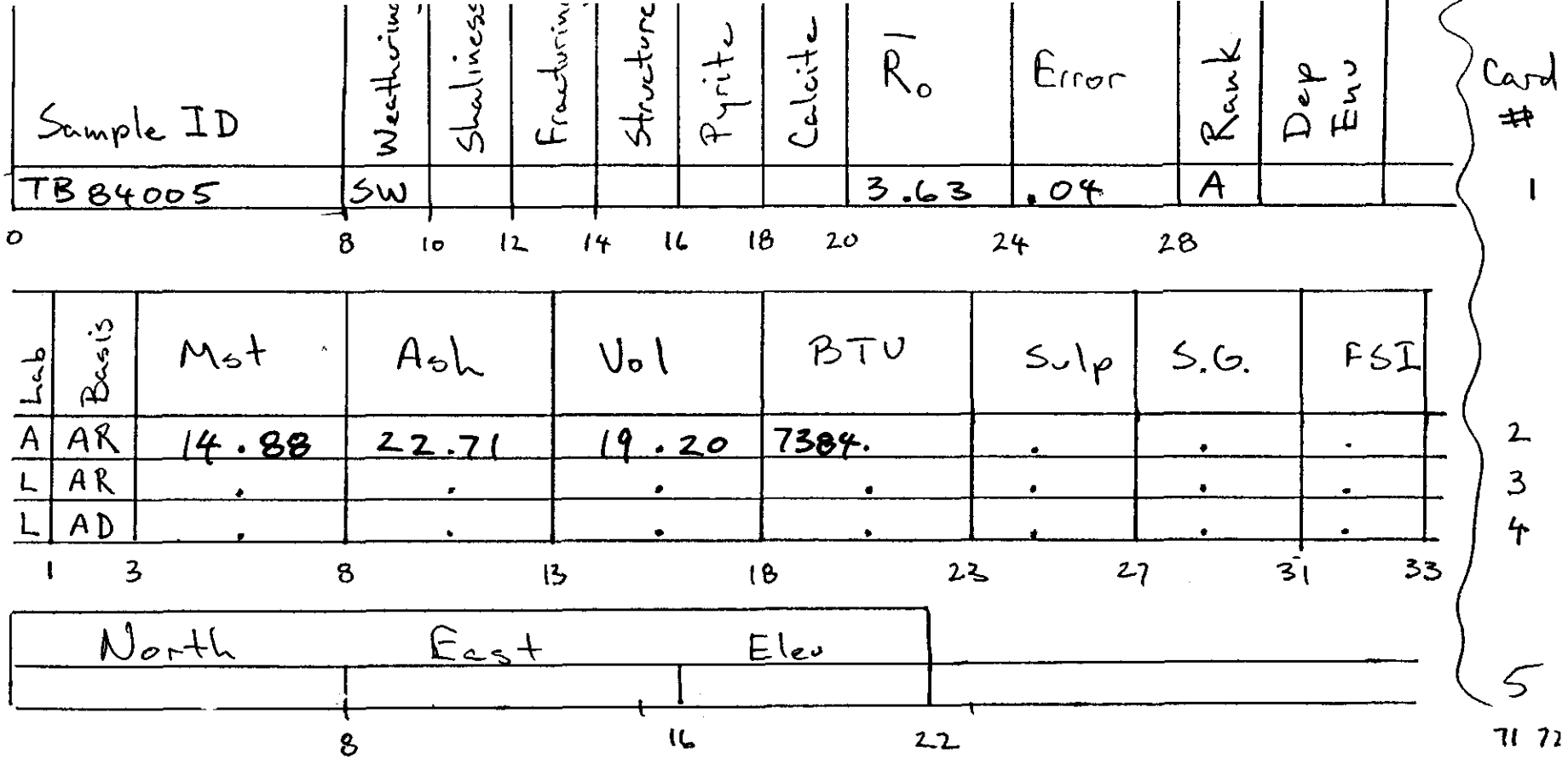

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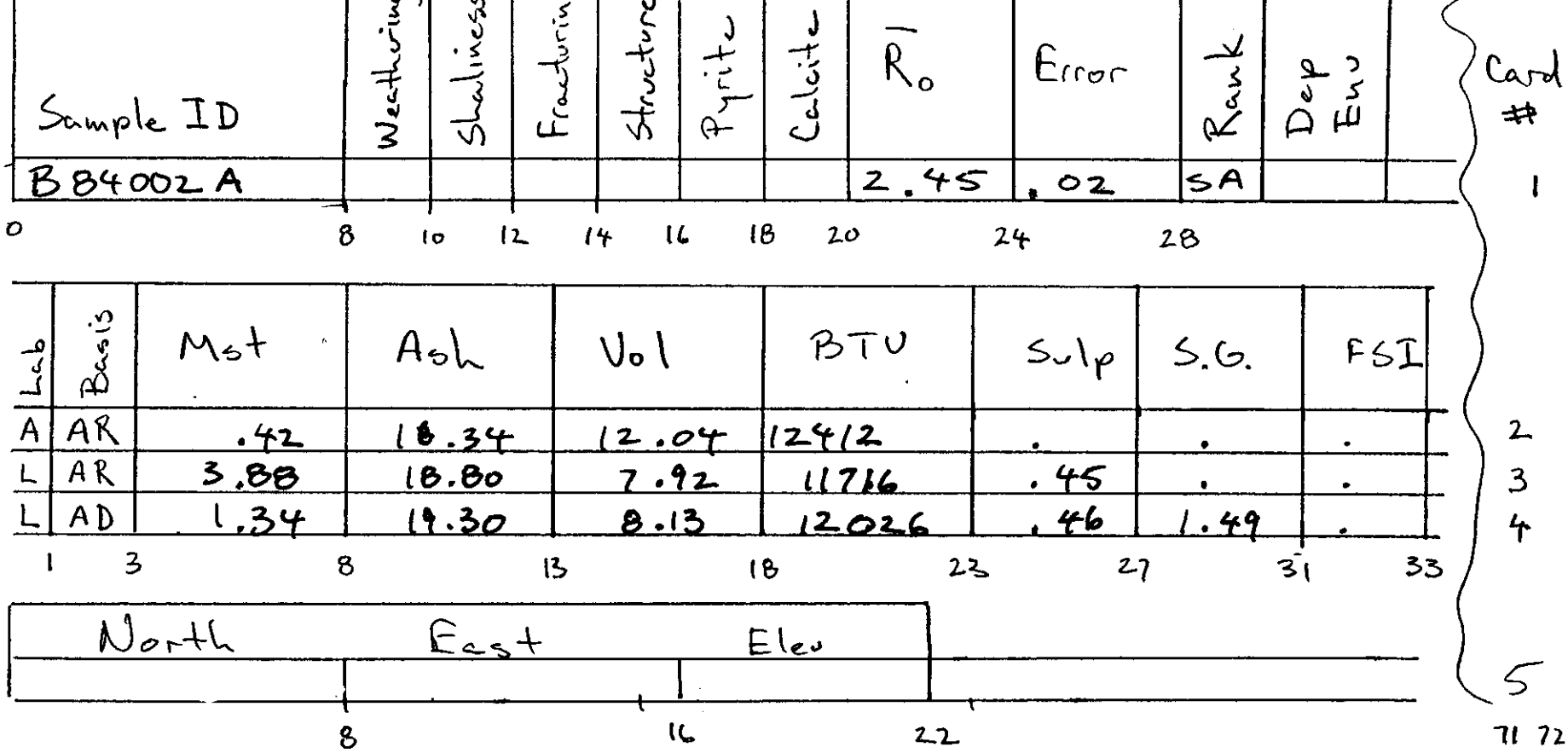

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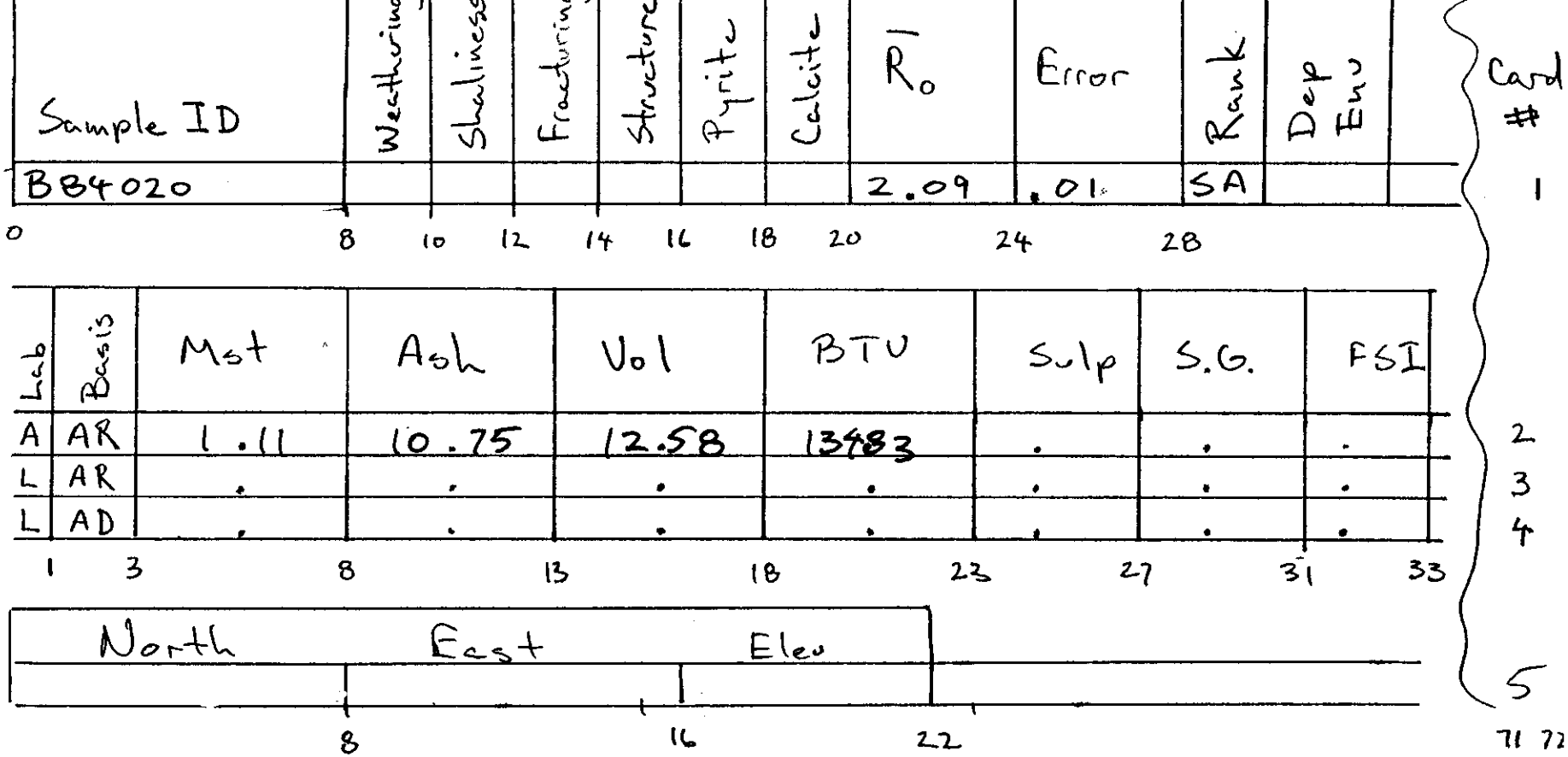

Keypunch

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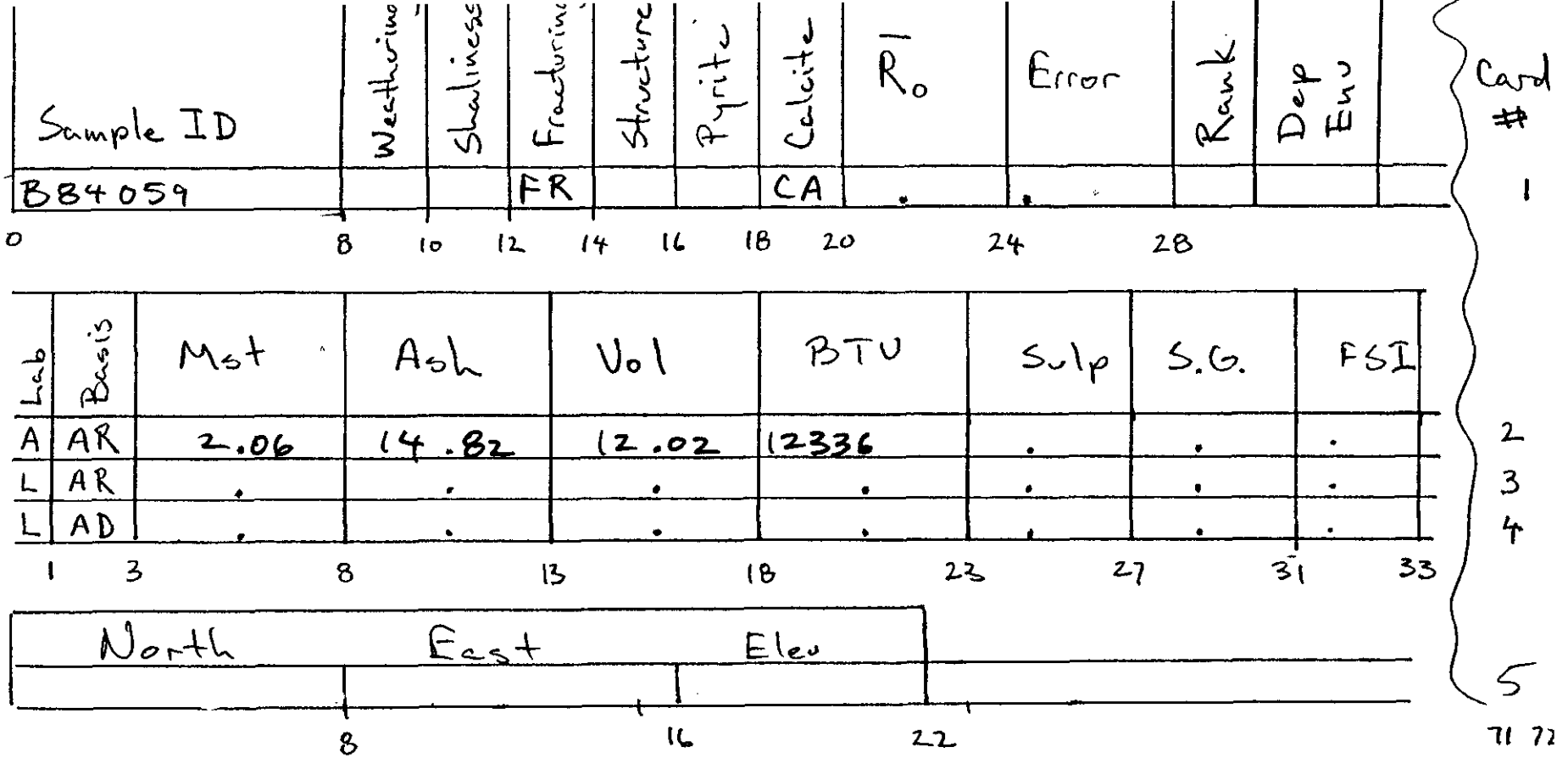

Keypunch

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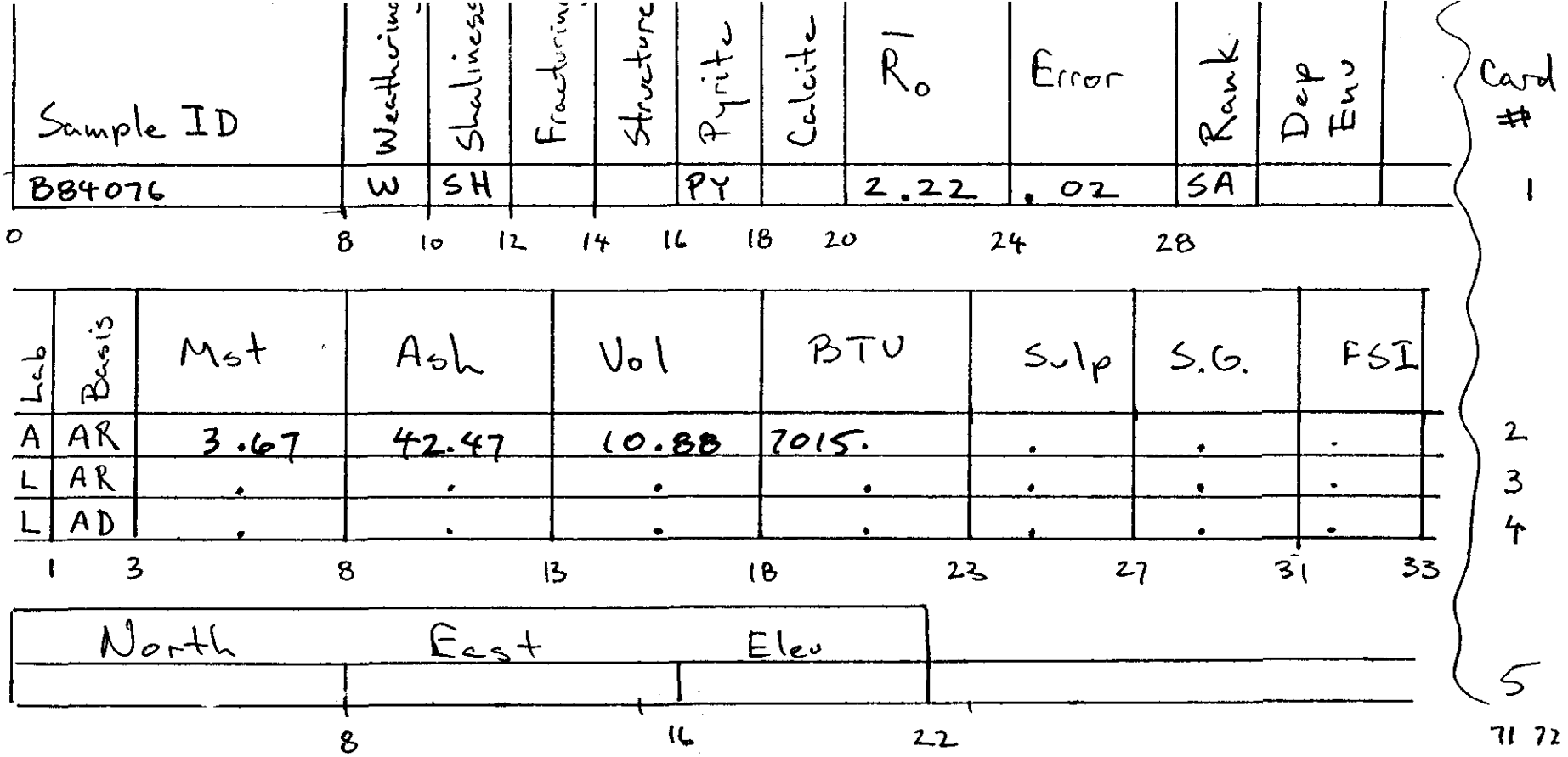

Keypunch

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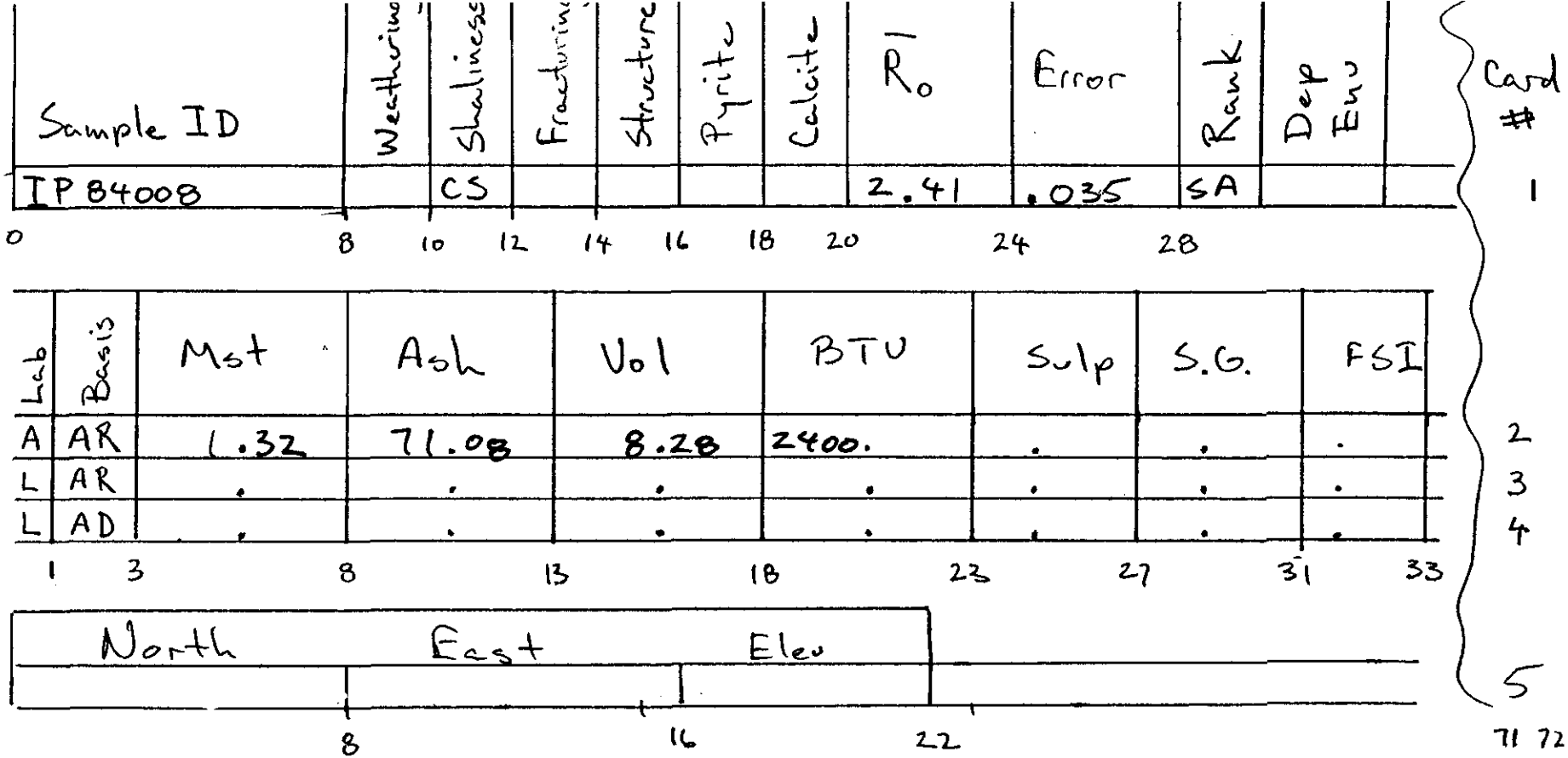

Keypunch

5 cards per observation (Sample ID)

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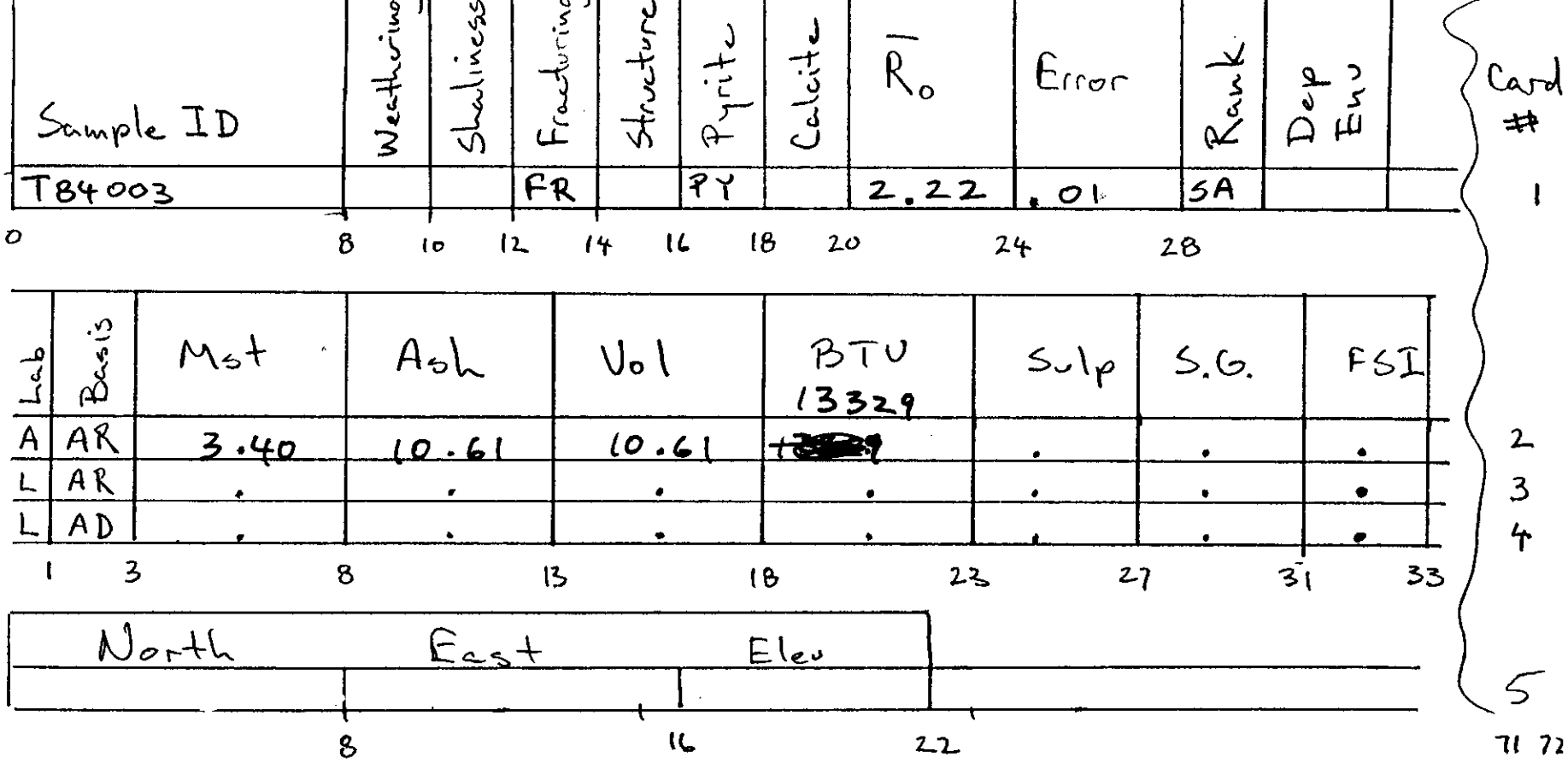
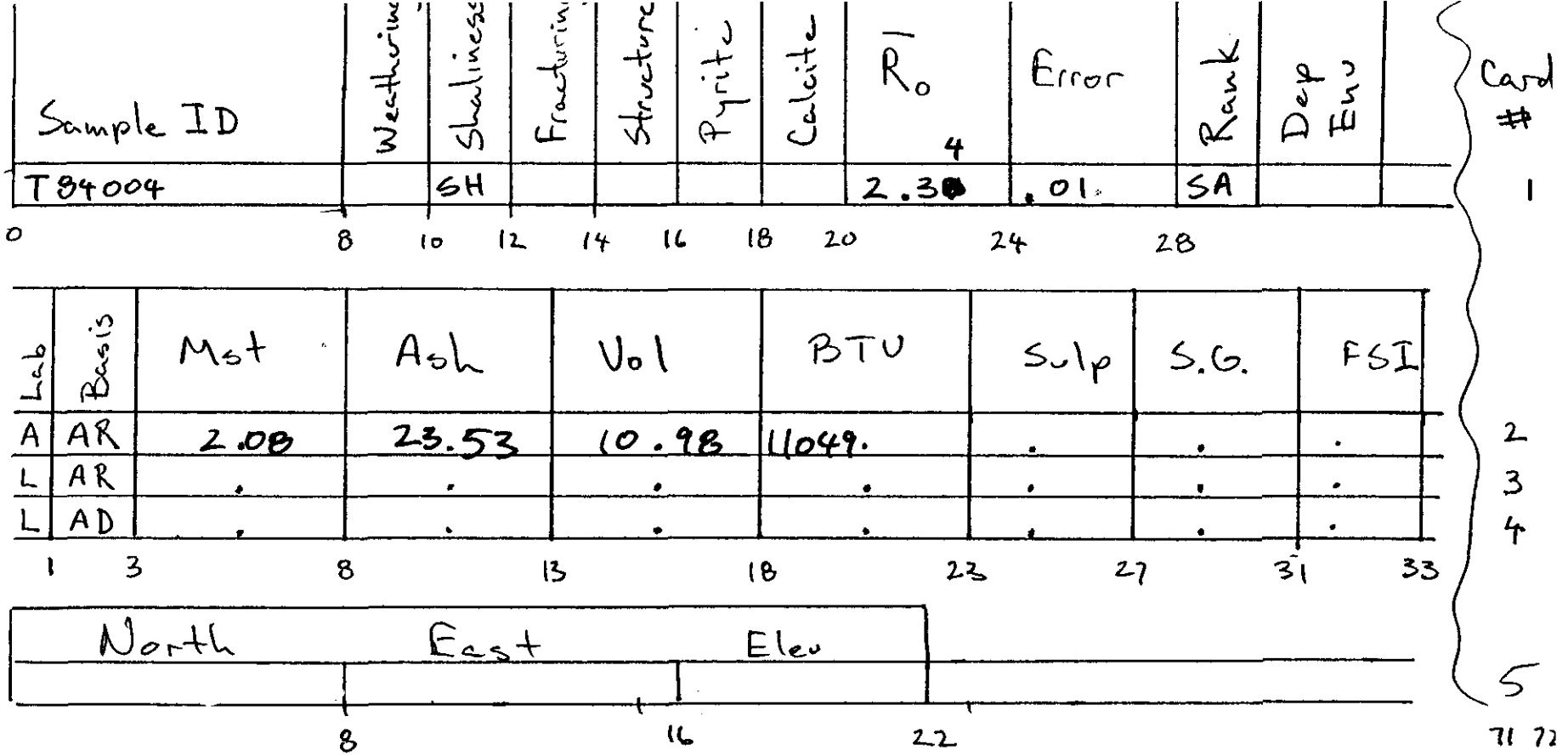


Keypunch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data



Keypunch

5 cards per observation (Sample ID)

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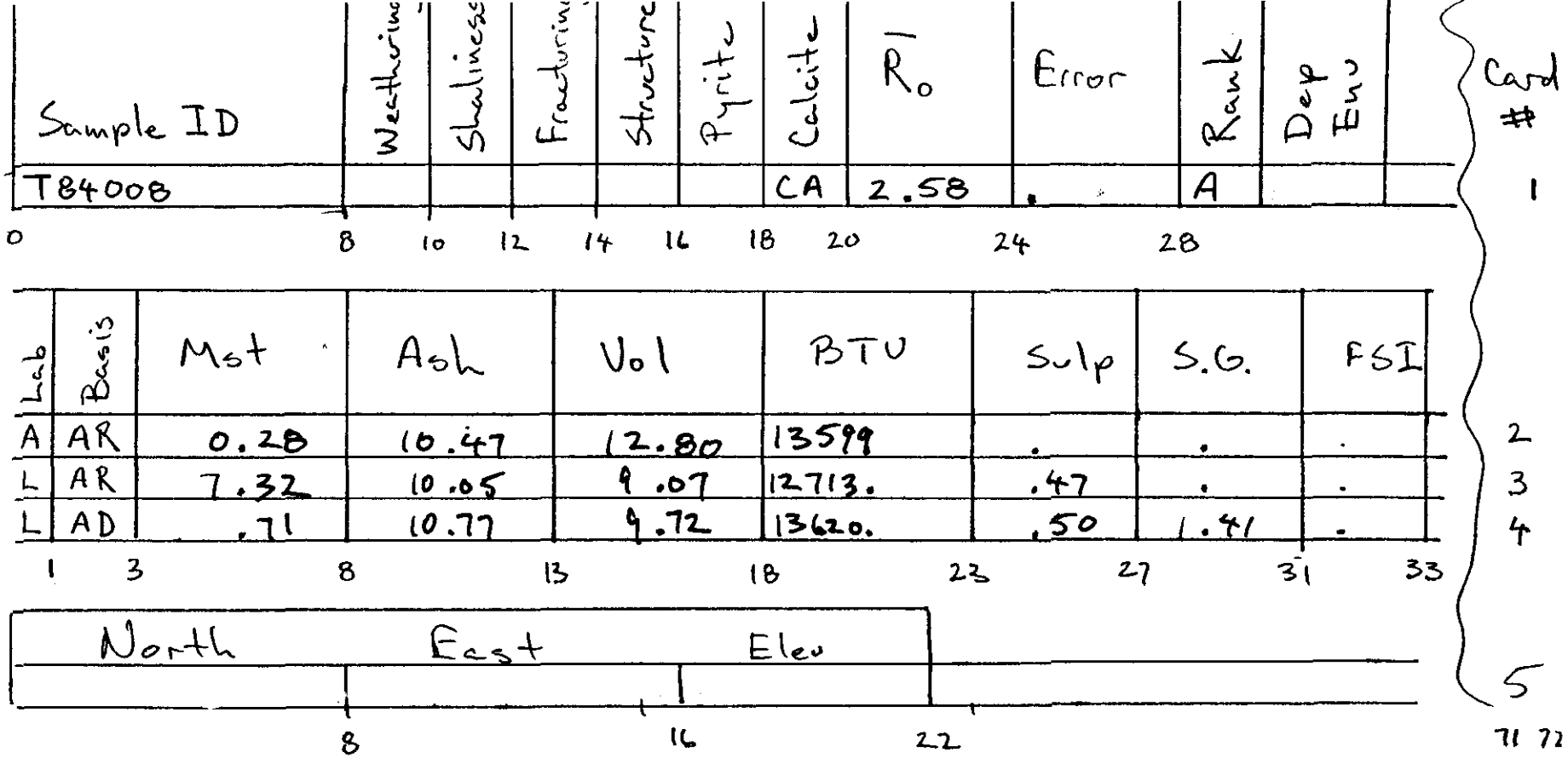

Keypunch

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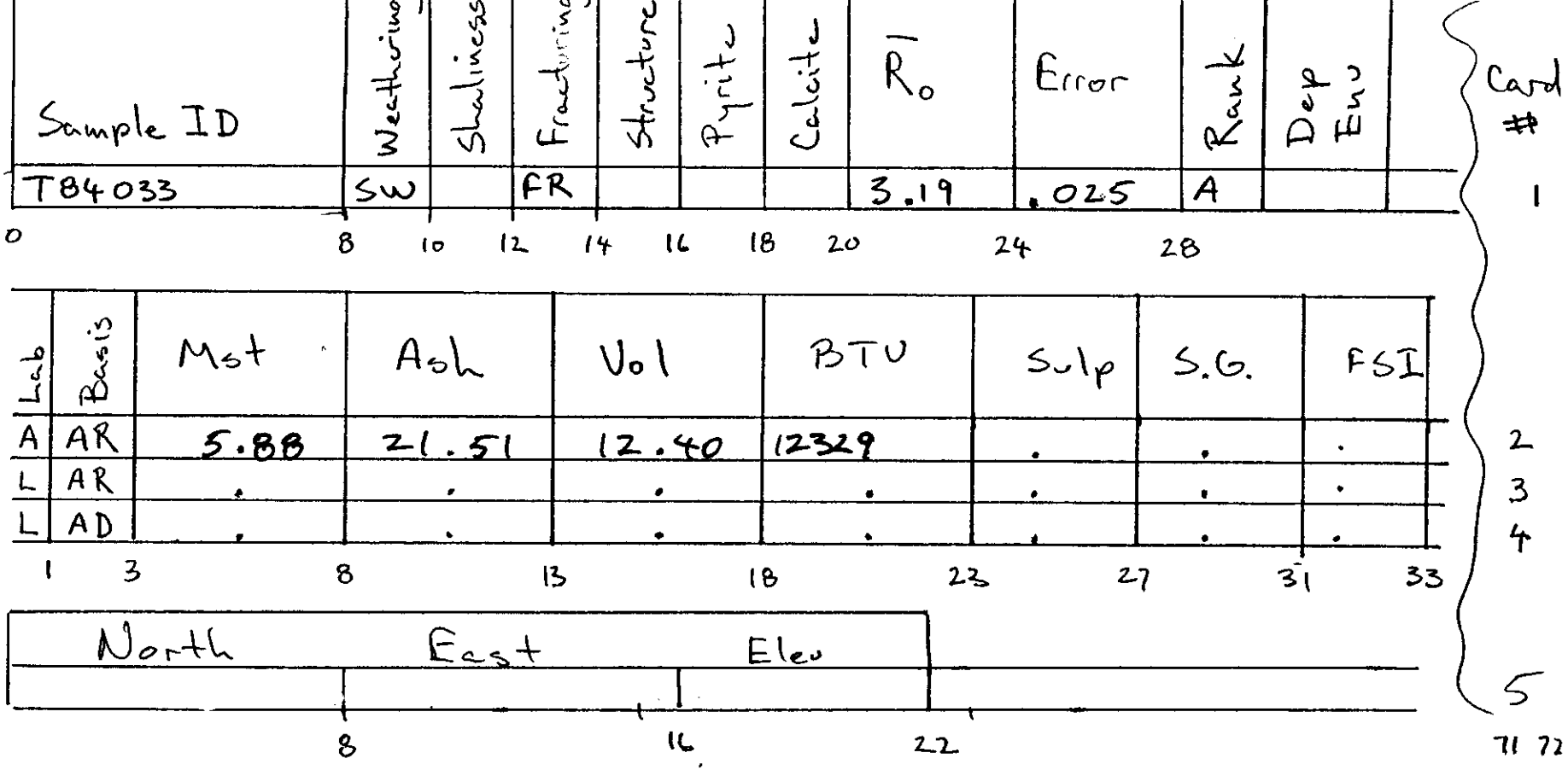

Keypunch

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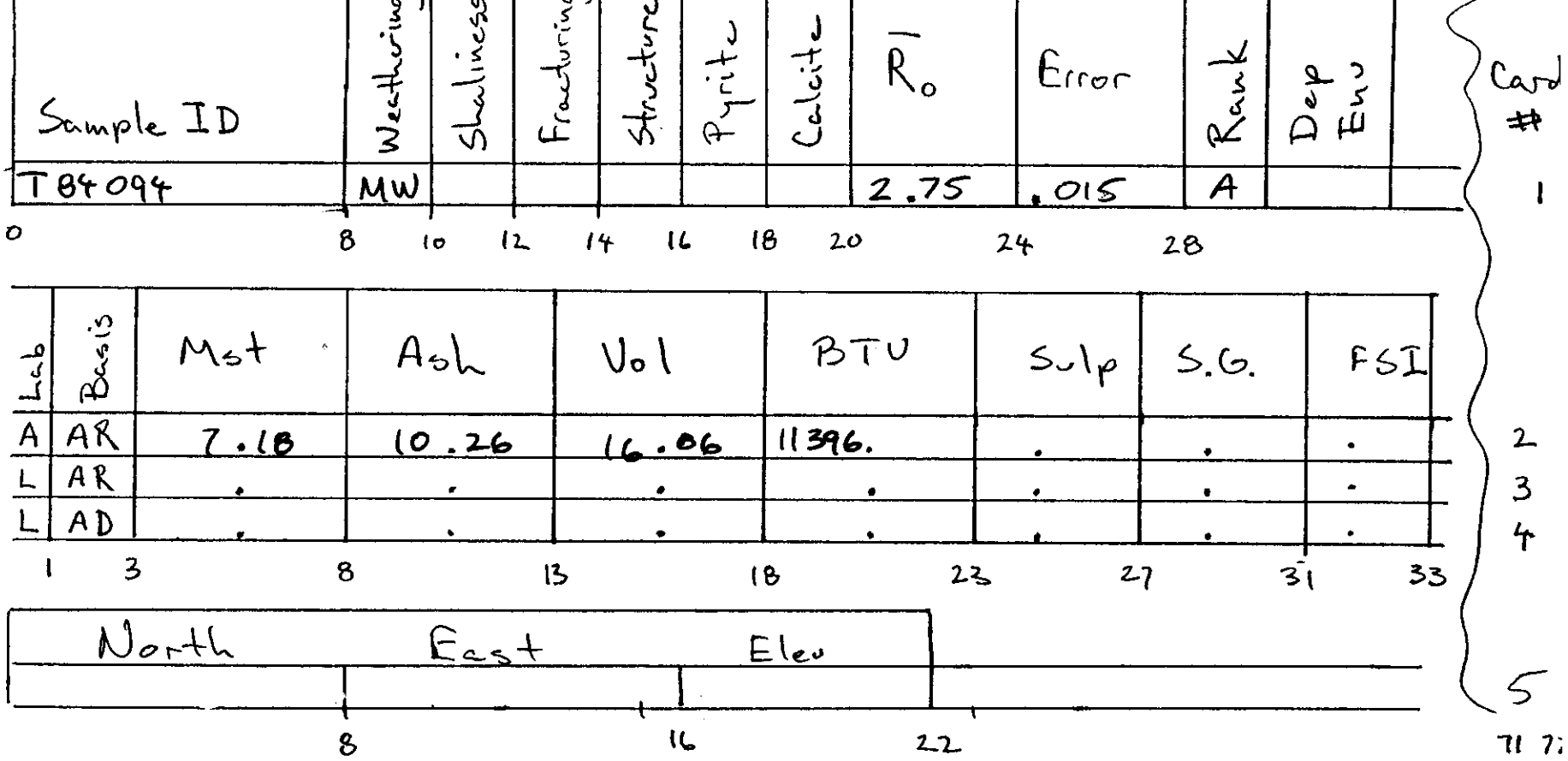
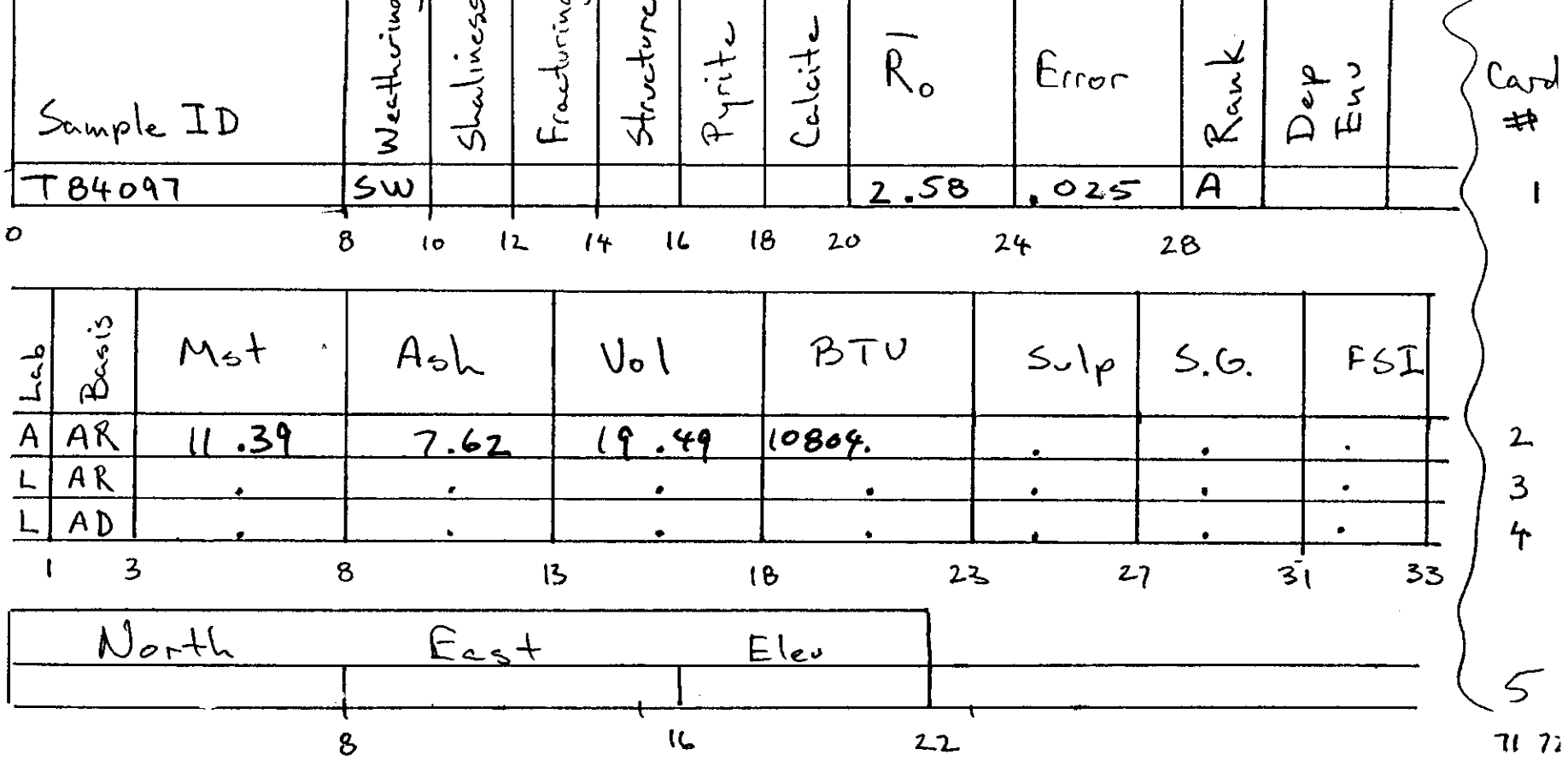


Keypunch

5 cards per observation (Sample ID)

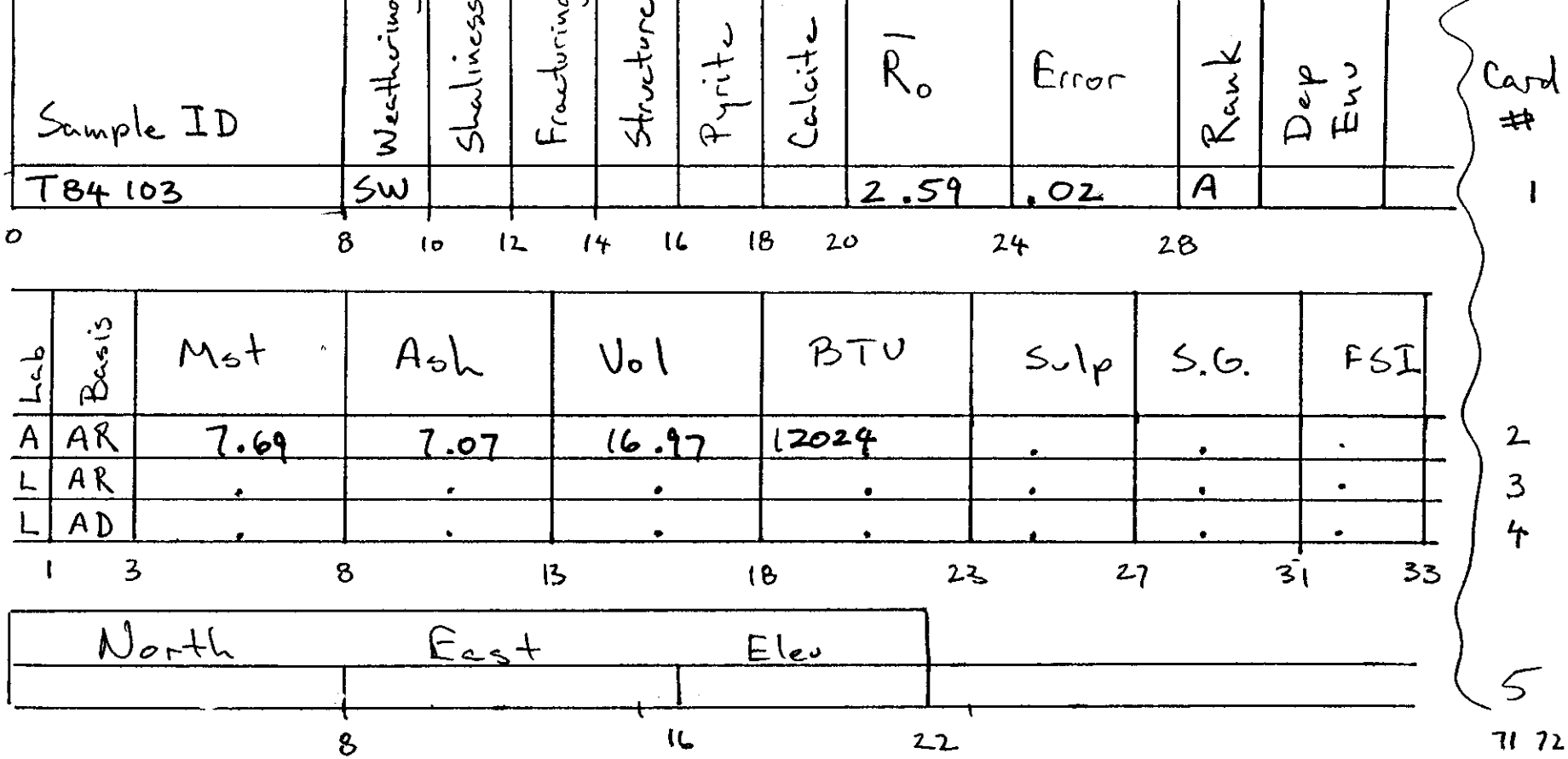
include '.'s as these indicate missing data



Keypunch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data



Keypunch

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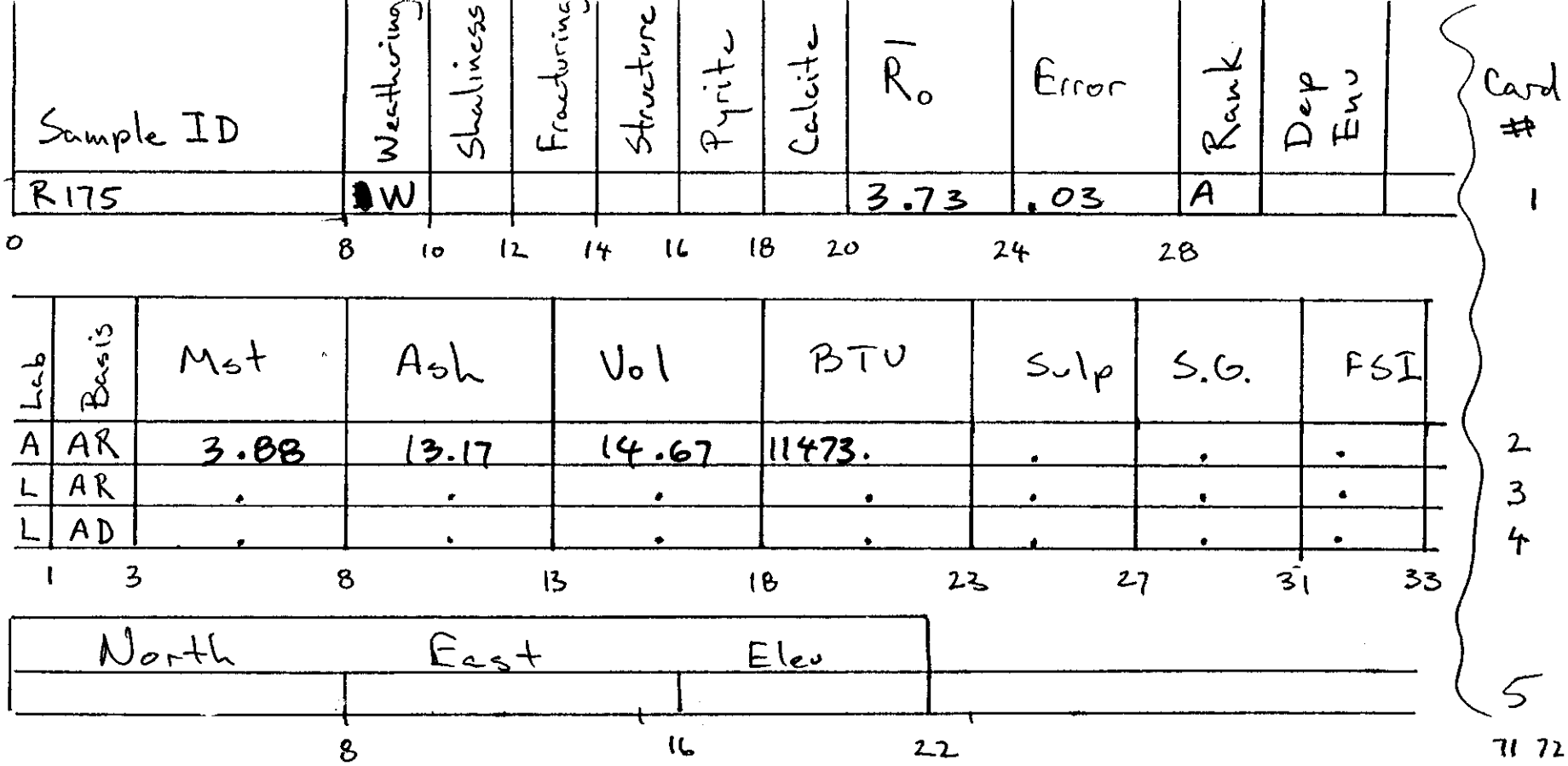

Keypunch

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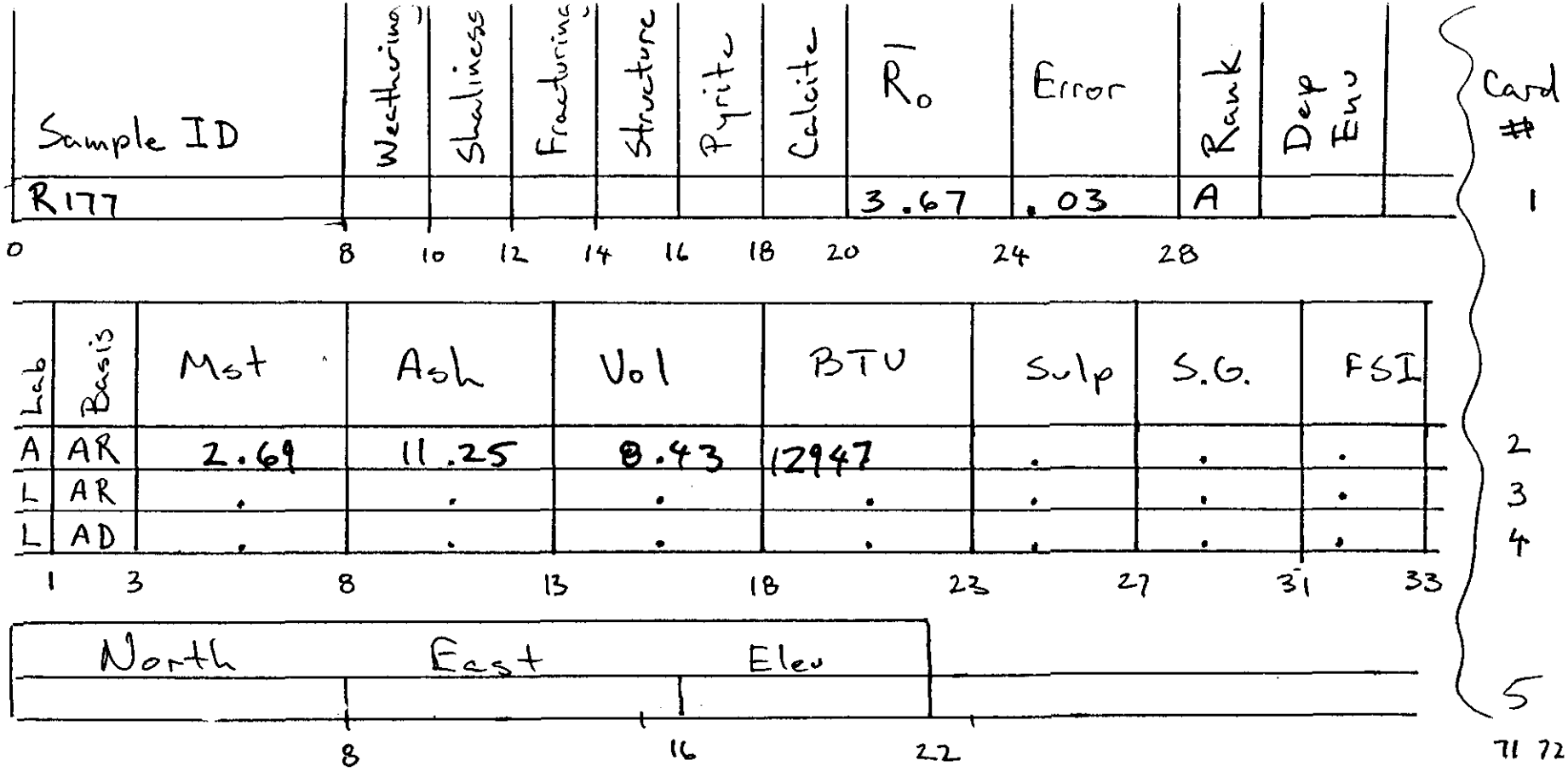
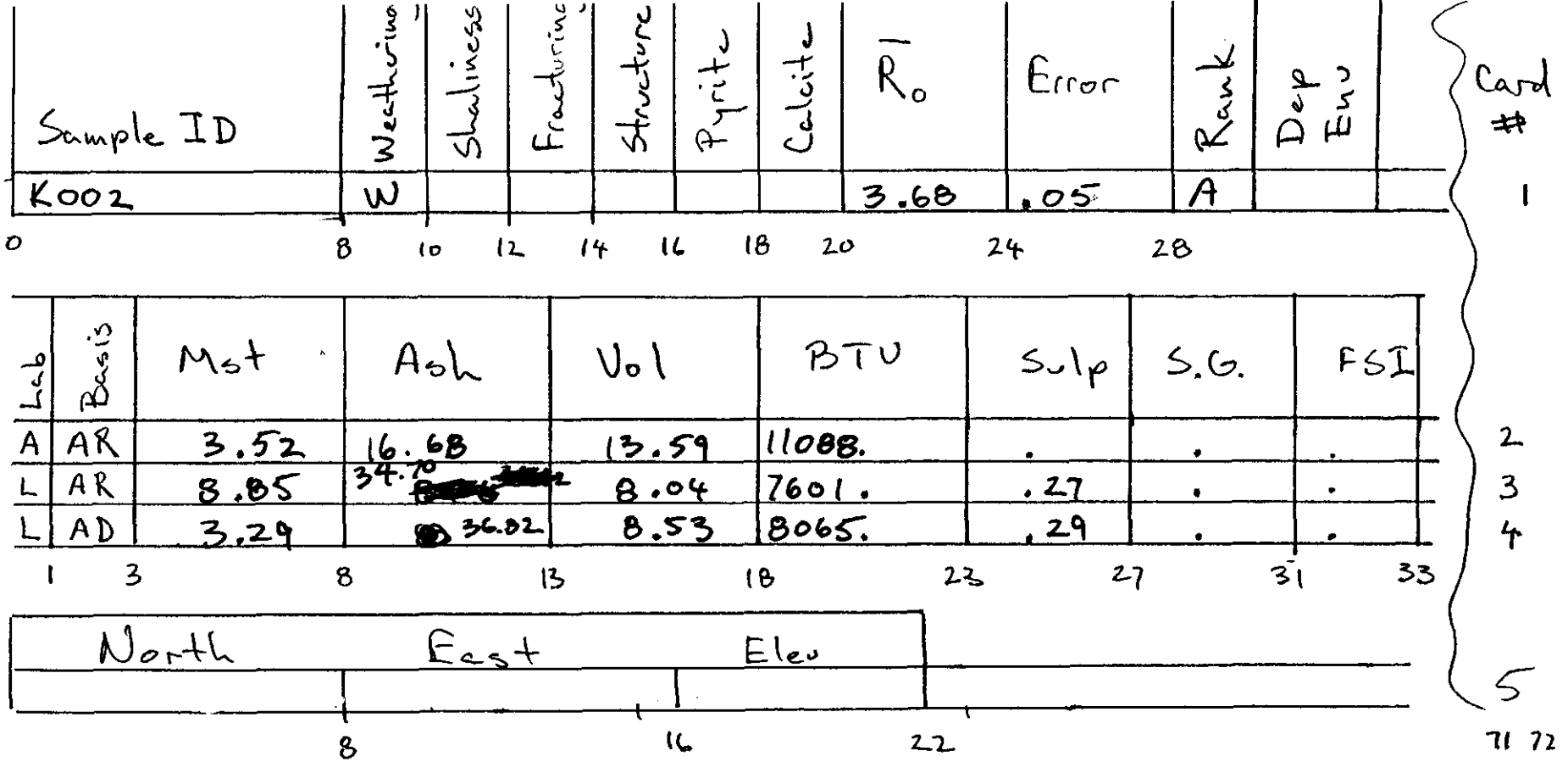


Keypunch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data



Keypunch

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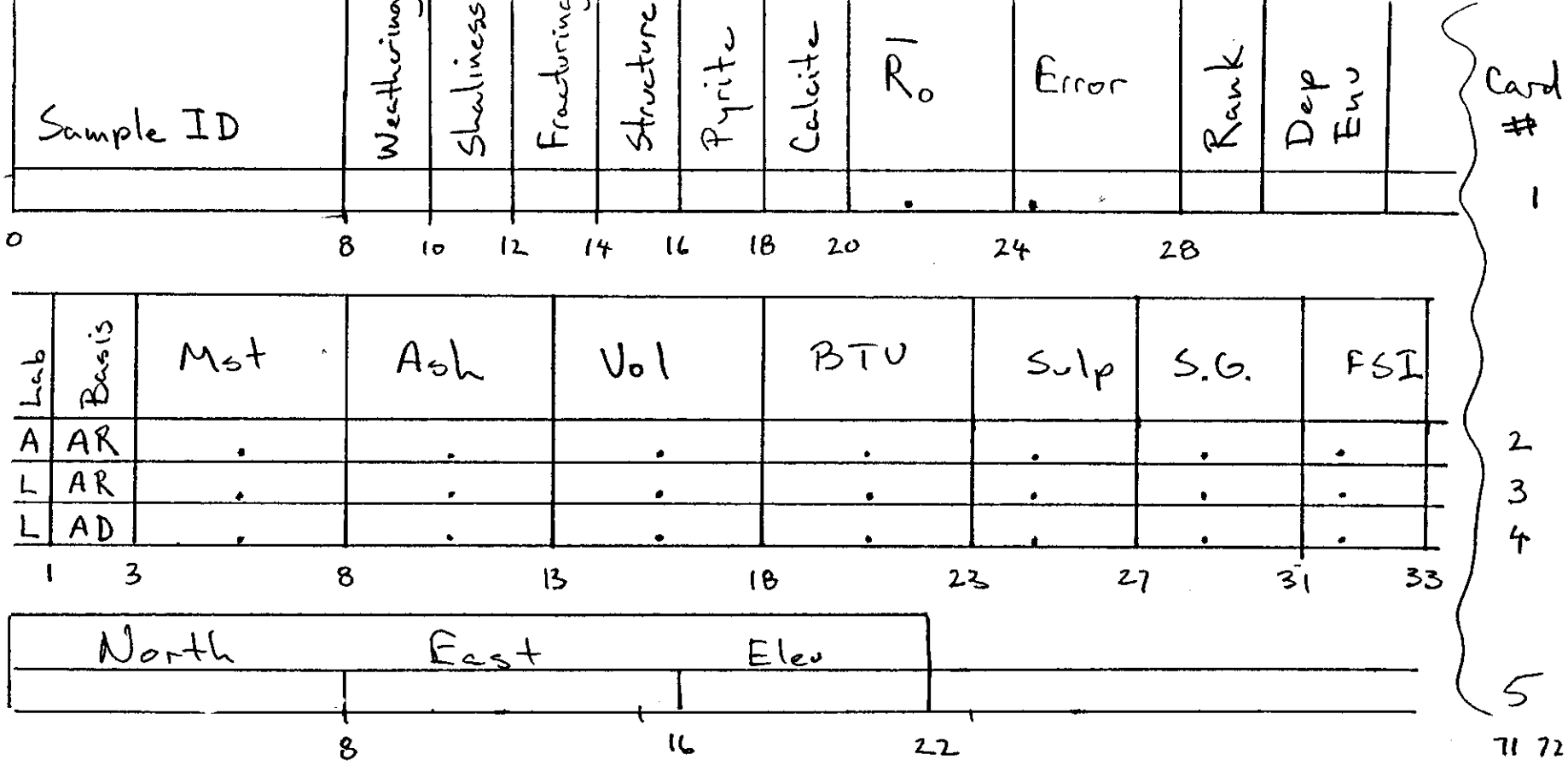
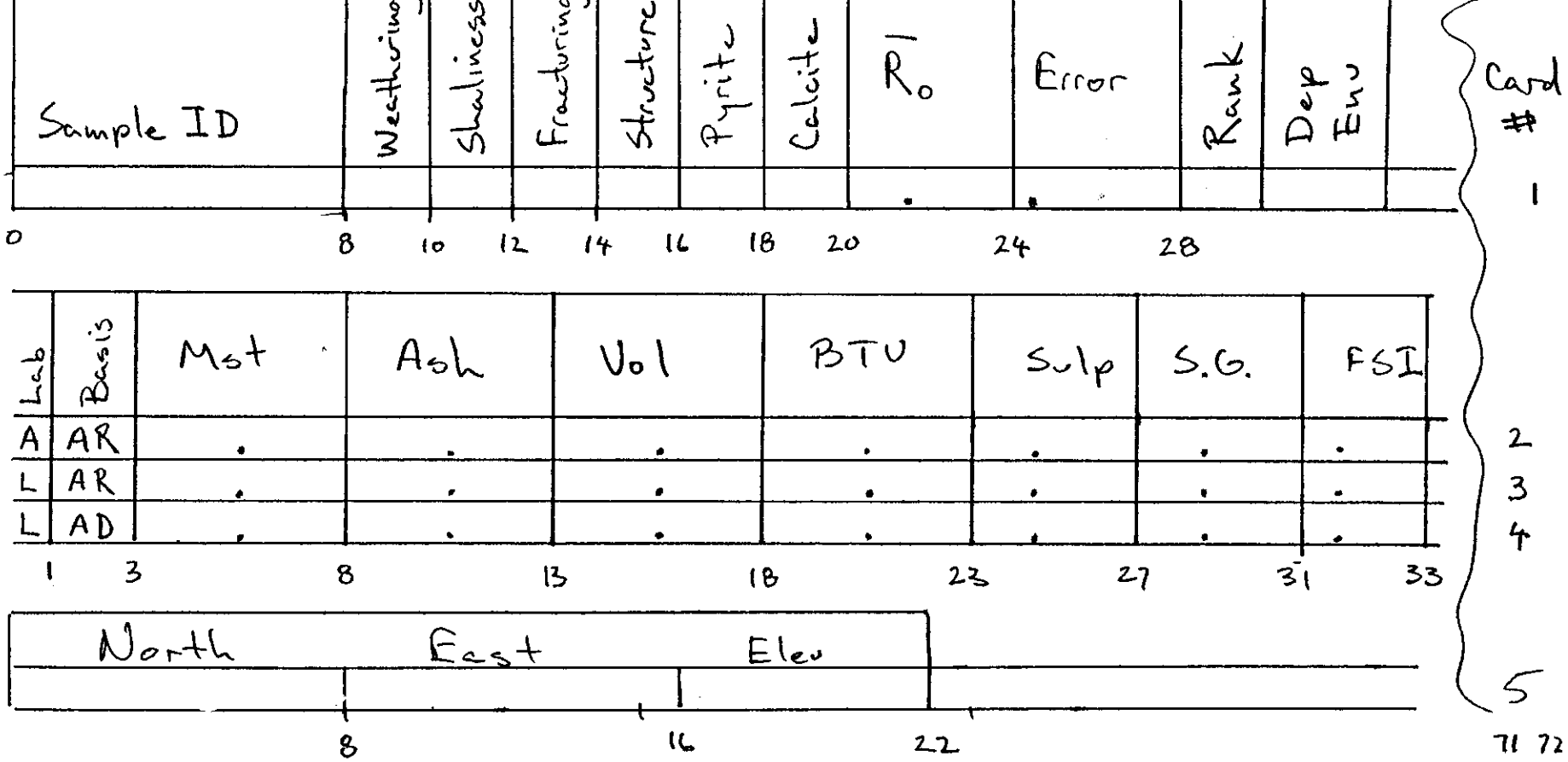


Keypunch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data



Keypunch

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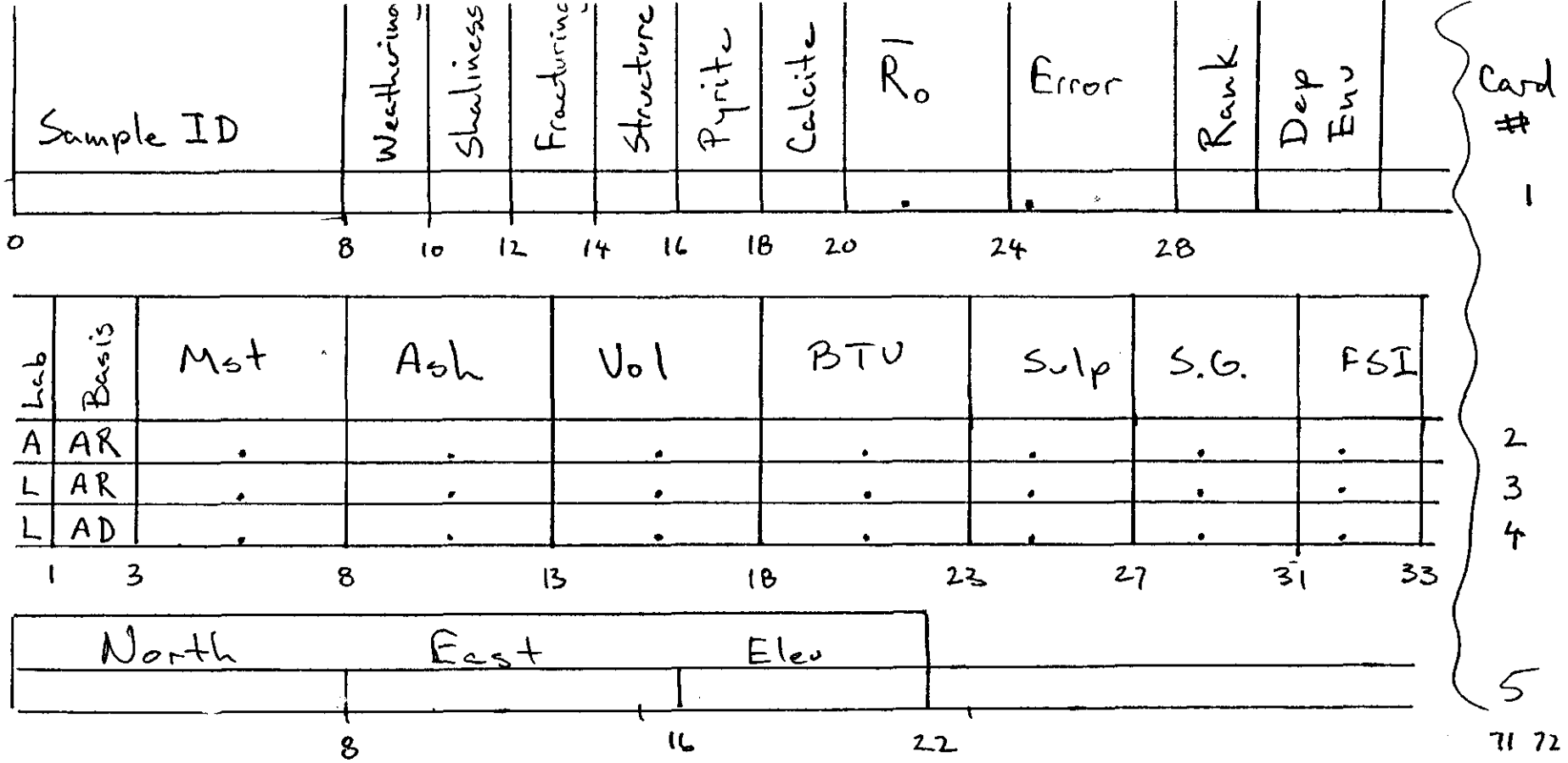

Keypunch

5 cards per observation (Sample ID)

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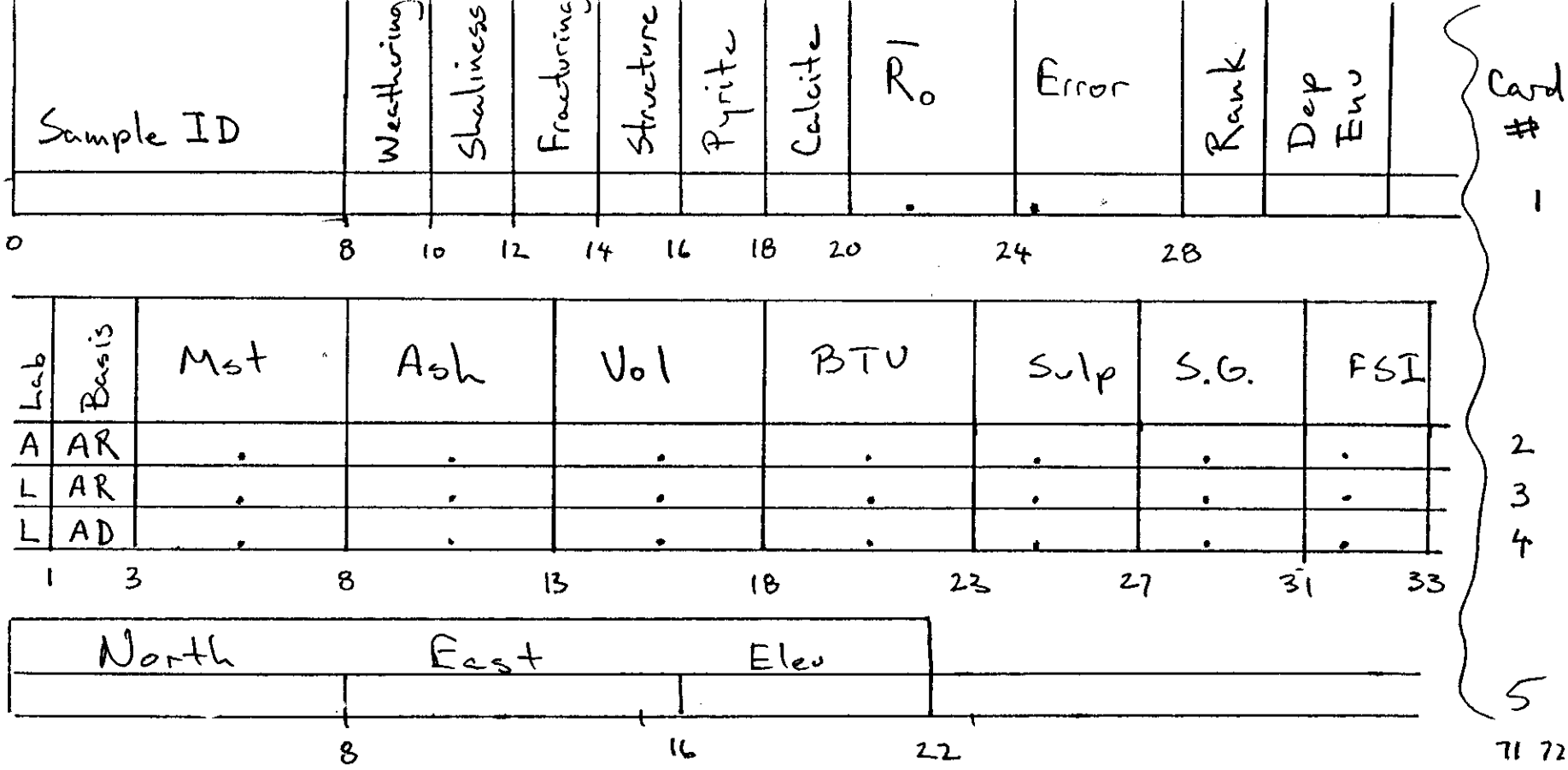
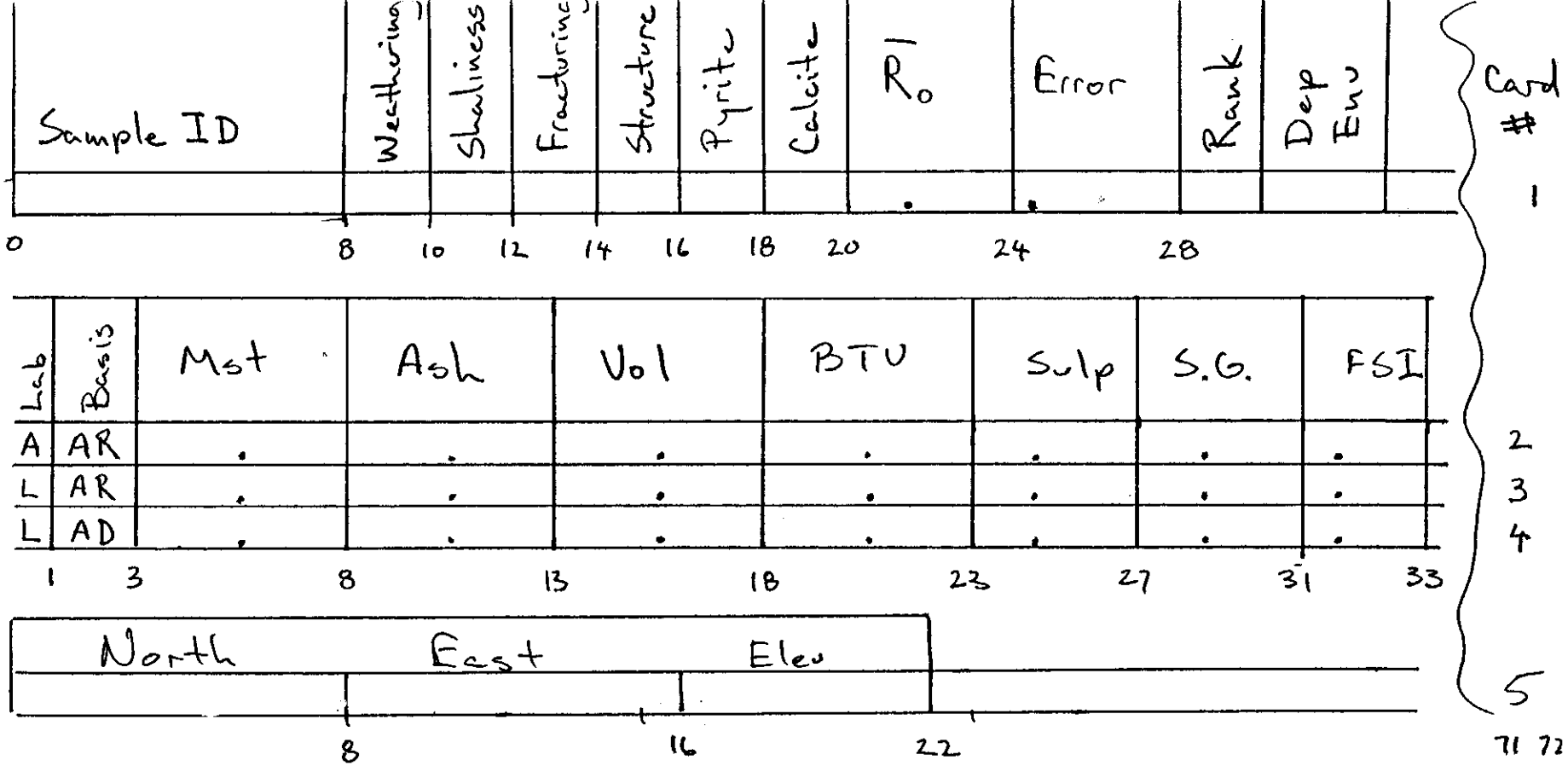


Keypunch

5 cards per observation (Sample ID)

include '.'s as these indicate missing data



Keypunch

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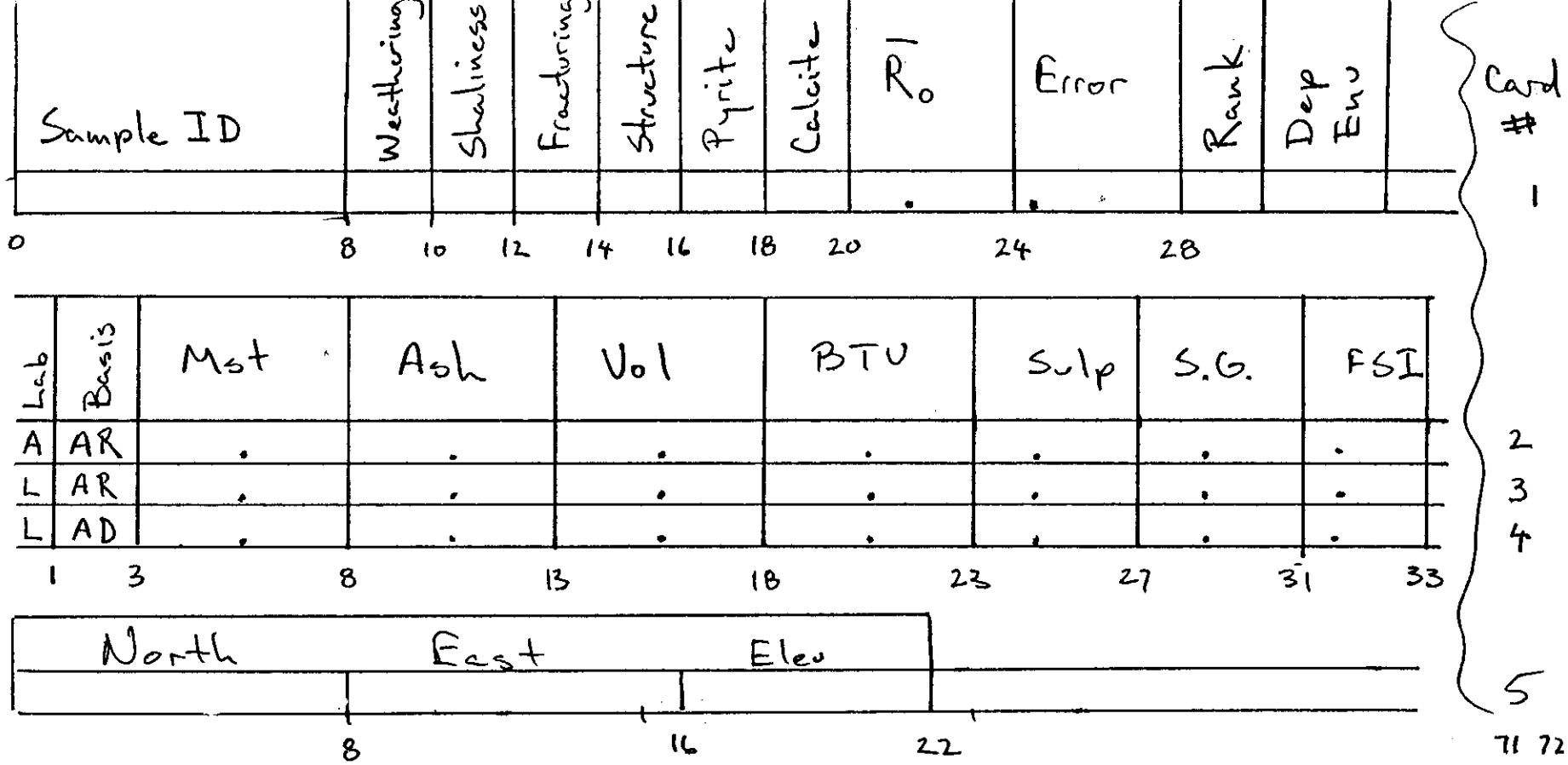

Keypunch

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