

Kentucky Department of Highways

HIGHWAY RESEARCH LABORATORY

TEST PROJECT F. A. 366, C1 AND C2,
HARRISON-PENDLETON COUNTIES

A MEMORANDUM REPORT

by

Milton Evans, Jr.
Research Engineer

March, 1958

University of Kentucky
Lexington

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ADDRESS REPLY TO
DEPARTMENT OF HIGHWAYS
MATERIALS RESEARCH LABORATORY
132 GRAHAM AVENUE
LEXINGTON 29, KENTUCKY

D. 1. 7.
C. 2. 4.

MEMO TO: W. B. Drake
Associate Director of Research

SUBJECT: Test Project F. A. 366, C1 and C2,
Harrison-Pendleton Counties

This project, located on US 27, was designed to provide performance data on concrete durability over a period of years. The pavement, totaling 7.89 miles, was constructed in ten experimental test sections, as shown on the layout map in Figure 1. Five blends of cement, containing portland, natural and two different air-entraining agents, were used with two types of coarse aggregate -- limestone and river gravel. Since the construction of the pavement in the summer of 1941, reports and memoranda have been released dealing with several aspects of the over-all study:

1. Test results on cores taken in 1941; KDH, April, 1942.
 2. Results of freezing and thawing beams made in 1941; KDH, Aug. 1943.
 3. Supplement to Aug. 1943 freeze-and-thaw report; KDH, Nov. 1944.
 4. Summary report of concrete investigations in research projects; HMRL, Dec. 1945.
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5. Experiments with air entrainment in cement concrete; Engineering Experiment Station Bulletin No. 5, Sept. 1947. (The test sections are referred to as project C1 in this bulletin.)
6. Inspection report; HMRL, June 1953.
7. Inspection report; HMRL, June 1957.

Although a complete performance report is already in preparation, this present memorandum is intended as a convenient summary of certain significant aspects of the project. These will be dealt with herein as follows:

1. Materials and sources (Table 1).
2. Design variables (Tables 1 & 2).
3. Strengths of cores taken to date (Fig. 4 and Table 3).
4. Degree of spalling (Table 3 and Fig. 3).
5. Crack and joint frequency and condition (Crack Survey, Fig. 2 and Table 3).

The information presented here is arranged to permit comparison of the test sections with consideration for each section's basic design factors and performance data after 16 years of service. Table 3 is intended as a summary sheet for the performance data, so that by taking design differences into account a comparative evaluation can be made of each section.

Respectfully submitted,

Milton Evans, Jr.
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Research Engineer

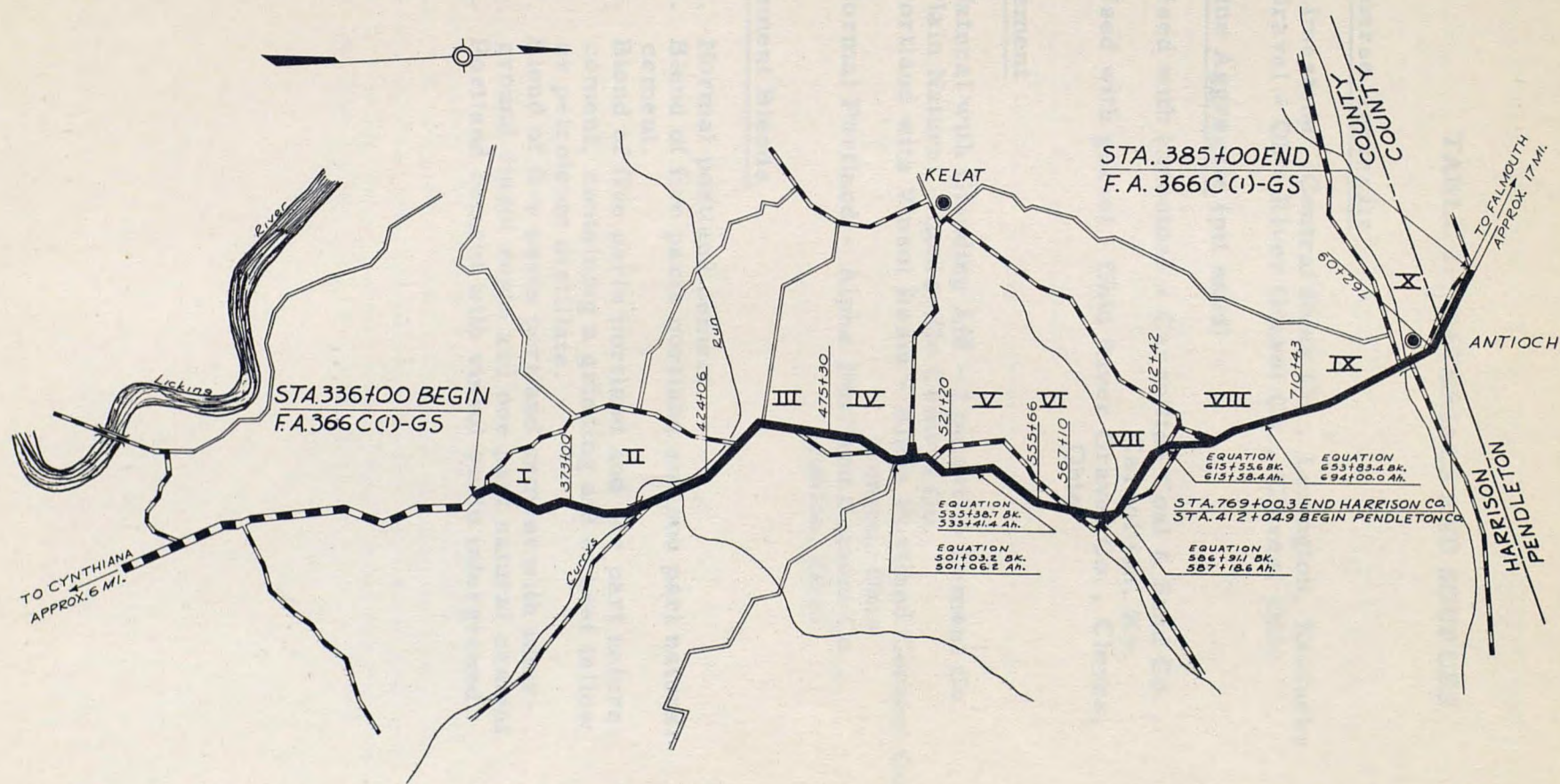


FIG. 1: Layout Map Showing Location of Test Pavement

TABLE 1: MATERIALS AND SOURCES

1. Coarse Aggregate

Limestone - Central Rock Co., Lexington, Kentucky
Gravel - Ohio River Gravel Co., Cleves, Ohio

2. Fine Aggregate (pit sand)

Used with limestone - Carrollton Coal & Sand Co.,
Carrollton, Ky.
Used with gravel - Ohio River Gravel Co., Cleves,
Ohio

3. Cement

Natural with Grinding Aid - Louisville Cement Co.
Plain Natural - Louisville Cement Co.
Portland with Vinsol Resin - Alpha Portland Cement Co.,
Ironton, Ohio
Normal Portland - Alpha Portland Cement Co.,
Ironton, Ohio

4. Cement Blends

- A. Normal portland cement.
- B. Blend of five parts portland and one part natural cement.
- C. Blend of five parts portland and one part natural cement, containing a grinding aid of beef tallow or petroleum distillate.
- D. Blend of five parts portland cement with interground vinsol resin and one part natural cement.
- E. Portland cement with vinsol resin interground.

TABLE 2: SUMMARY OF DESIGN CHARACTERISTICS
OF TEST SECTIONS

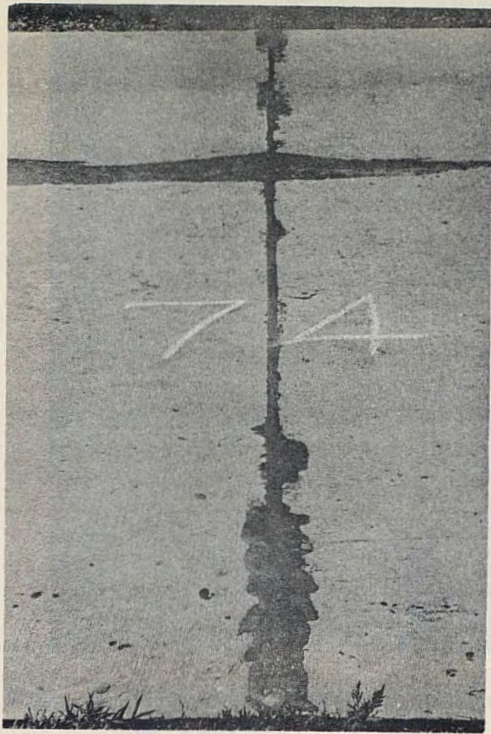
Section	Stations	Coarse Aggregate	Cement Combination	Average Air %
1	336+00 to 373+00	Limestone	E	3.3
10	762+09 to 385+00*	Gravel	E	2.7
2	373+00 to 424+06	Limestone	D	2.5
8	612+42 to 710+43	Gravel	D	1.7
3	424+06 to 475+30	Limestone	C	2.7
9	710+43 to 762+09	Gravel	C	2.6
4	475+30 to 521+20	Limestone	B	1.4
7	567+10 to 612+42	Gravel	B	0.8
5	521+20 to 555+66	Limestone	A	0.8
6	555+66 to 567+10	Gravel	A	0.3

*385+00 is the end of section ten and the north end of these ten experimental sections. The north end of section ten is in Pendleton County, and stationing begins here at 385+00 and runs south to Harrison County line, where stations in Harrison County running from south to north also end.

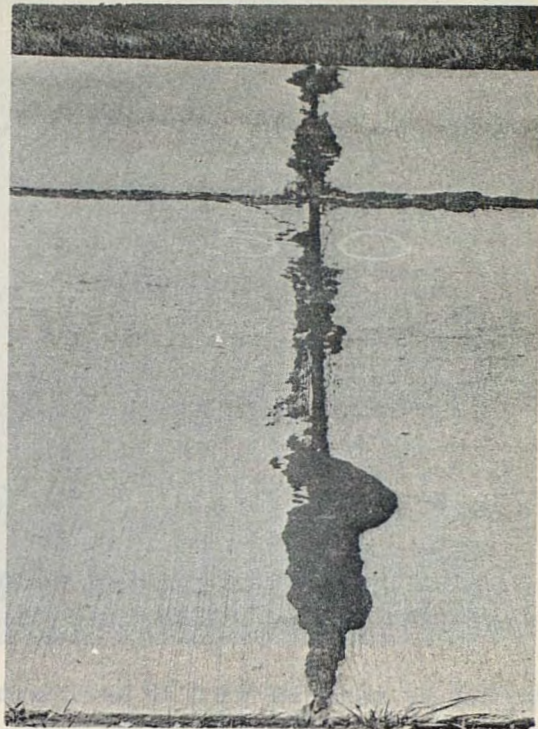
TABLE 3: SUMMARY OF DATA BY SECTIONS

SECTION NO.	I	II	III	IV	V	VI	VII	VIII	IX	X
Approx. Jt. Spacing	60 ft.	60 ft.	60 ft.	60 ft.	60 ft.	30 ft.	30 ft.	30 ft.	30 ft.	30 ft.
A Cracks / Mi.*	55.65	48.60	23.70	8.05	18.39	120.00	92.04	138.74	146.15	170.03
A Joints / Mi.	82.77	88.90	85.33	72.47	81.21	69.23	62.91	71.20	103.22	95.15
A Cracks / Slab	0.64	0.57	0.27	0.097	0.20	0.94	0.61	0.81	0.88	0.97
B Cracks / Mi.*	2.85	--	--	--	1.53	--	--	--	--	--
B Joints / Mi.	5.71	1.03	4.12	10.35	7.66	55.38	78.04	88.54	50.08	70.19
B Cracks / Slab	0.03	--	--	--	0.02	--	--	--	--	--
C Joints / Mi.*	--	--	--	1.15	1.53	4.61	8.15	10.95	8.18	7.82
D Joints / Mi.*	--	--	--	--	--	--	2.34	1.83	6.12	3.13
Half Lane Cracks / Mi.	51.37	43.43	19.58	5.75	13.79	46.15	40.78	50.20	47.01	42.12
Full Lane Cracks / Mi.	4.28	5.17	4.12	2.30	6.13	73.84	51.26	88.54	99.14	127.91
Total Cracks / Mi.	55.65	50.67	23.70	8.05	19.92	119.99	92.04	138.74	146.15	170.03
Total Joints / Mi.	88.48	89.33	89.65	83.97	90.40	129.22	151.45	172.52	167.60	176.29
Total Cracks / Slab	0.64	0.57	0.27	0.097	0.22	0.94	0.61	0.81	0.88	0.97
Total Cracks and Joints / Mi.	144.13	140.00	113.35	92.02	110.32	249.21	243.49	311.26	313.85	346.32
Avg. Crack and Joint Spacing	36.63 ft.	37.71 ft.	46.58 ft.	57.38 ft.	47.86 ft.	21.19 ft.	21.68 ft.	16.96 ft.	16.82 ft.	15.25 ft.
Avg. Comp. Strengths of Cores, '57	4714 Psi.	4250 Psi.	4550 Psi.	4888 Psi.	6718 Psi.	7365 Psi.	6428 Psi.	5330 Psi.	6063 Psi.	6045 Psi.
Surface Spelling	None	None	0.76%	20.45%	22.55%	59.35%	1.24%	0.62%	None	None

* Crack and joint designations A, B, C, and D are as illustrated in fig. 2.



A - Fine crack or normal joint without spalling or other deterioration



B - Fine crack or normal joint with slight spalling and minor corner breaking



C - Enlarged crack or joint, showing considerable spalling and corner breaking



D - Greatly enlarged crack or joint, with excessive spalling and corner breaking

FIG. 2: Joints Illustrating Typical A, B, C, and D Conditions as Designated in Table 2

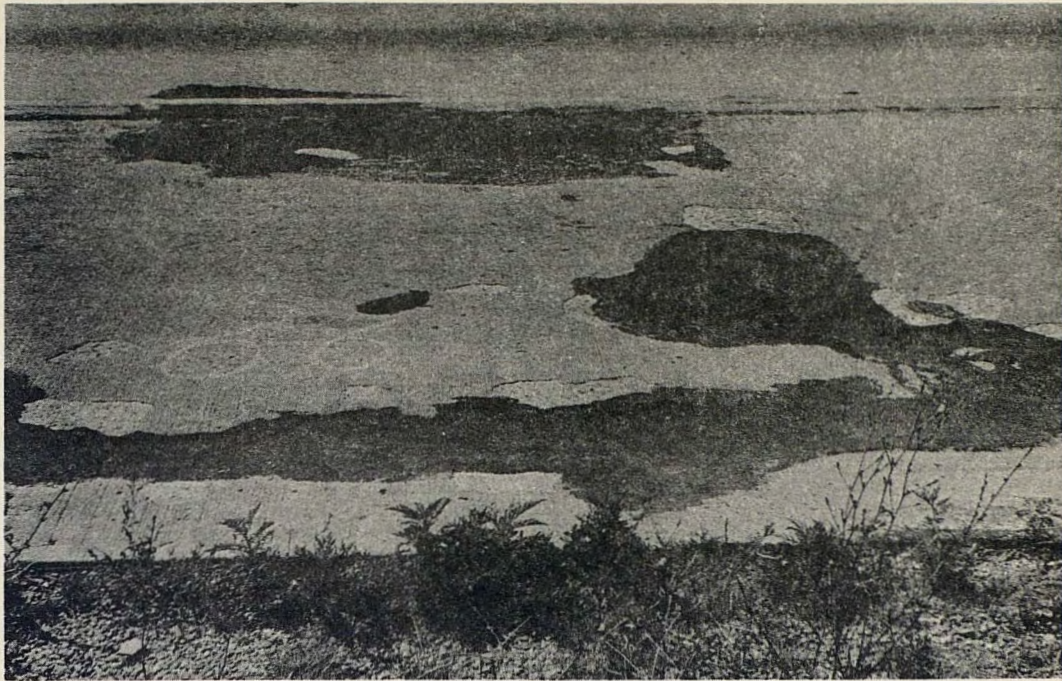


FIG. 3: Extensive Surface Spalling Encountered in Test Sections as Indicated in Table 3

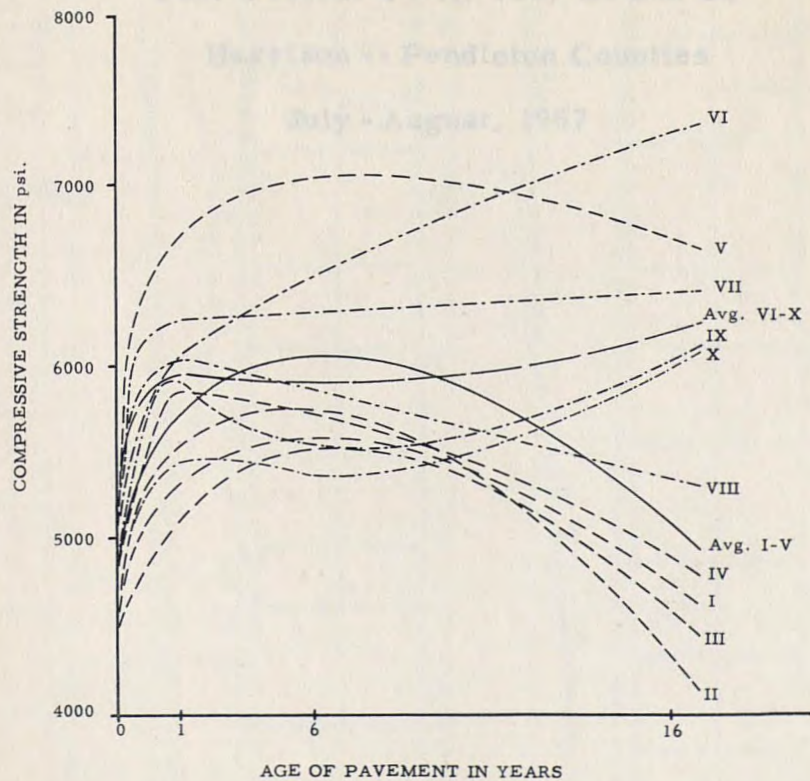
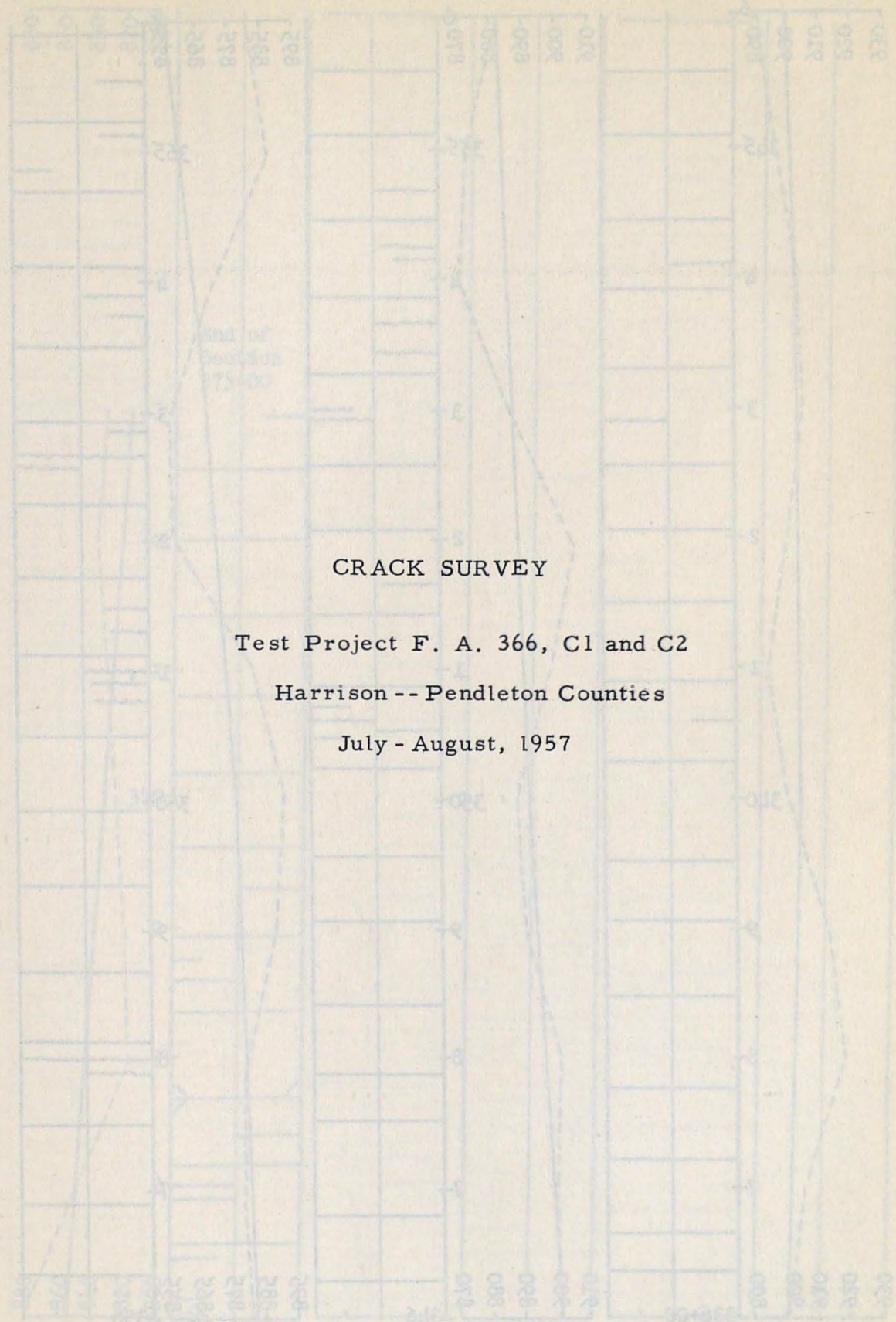


FIG. 4: Variation in Compressive Strength with Age, by Sections. Data were obtained from tests on cores taken in 1942, 1947, and 1957. Sections I through V contain limestone coarse aggregate; VI through X contain river gravel coarse aggregate.



CRACK SURVEY

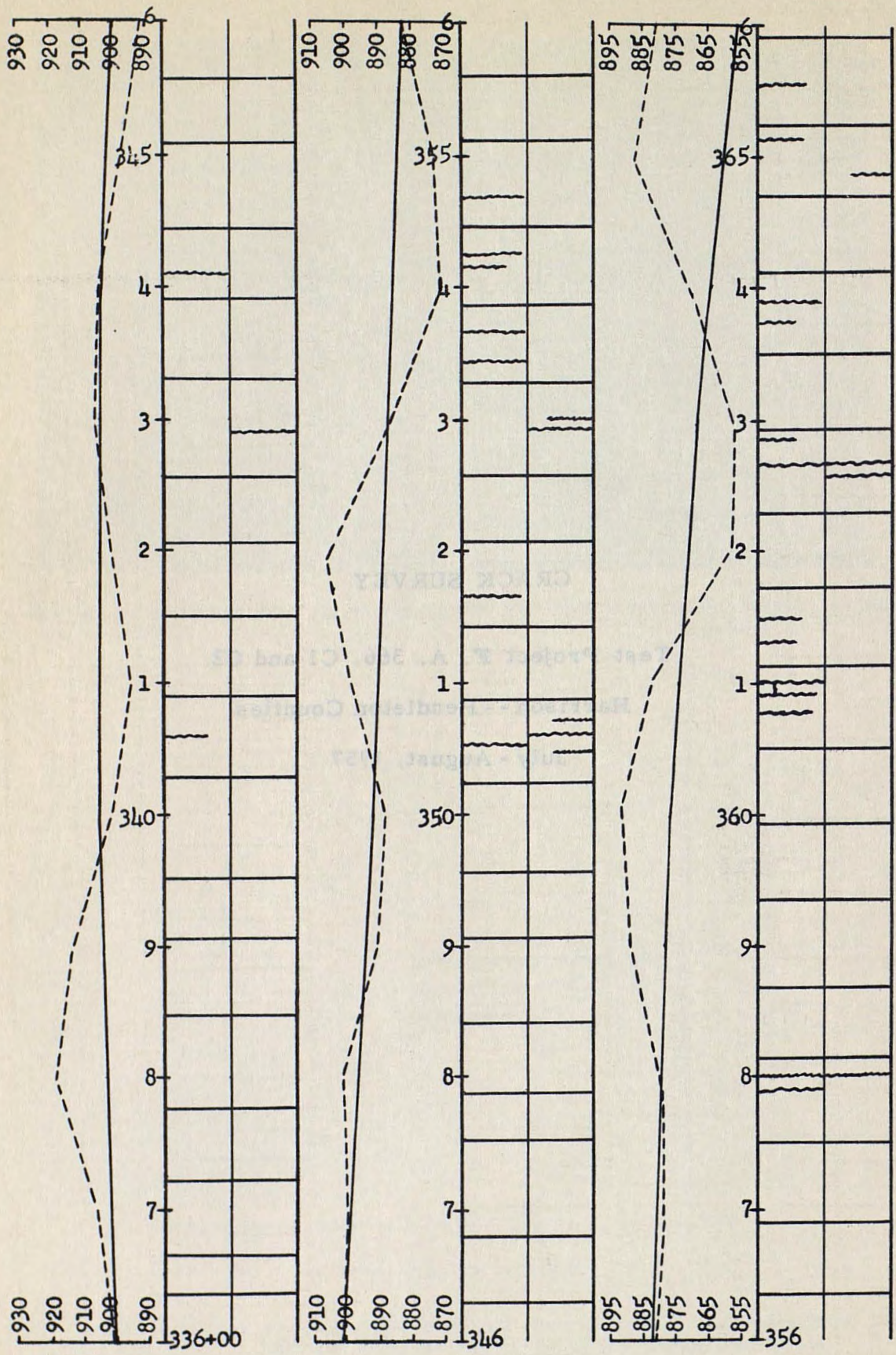
Test Project F. A. 366, C1 and C2

Harrison -- Pendleton Counties

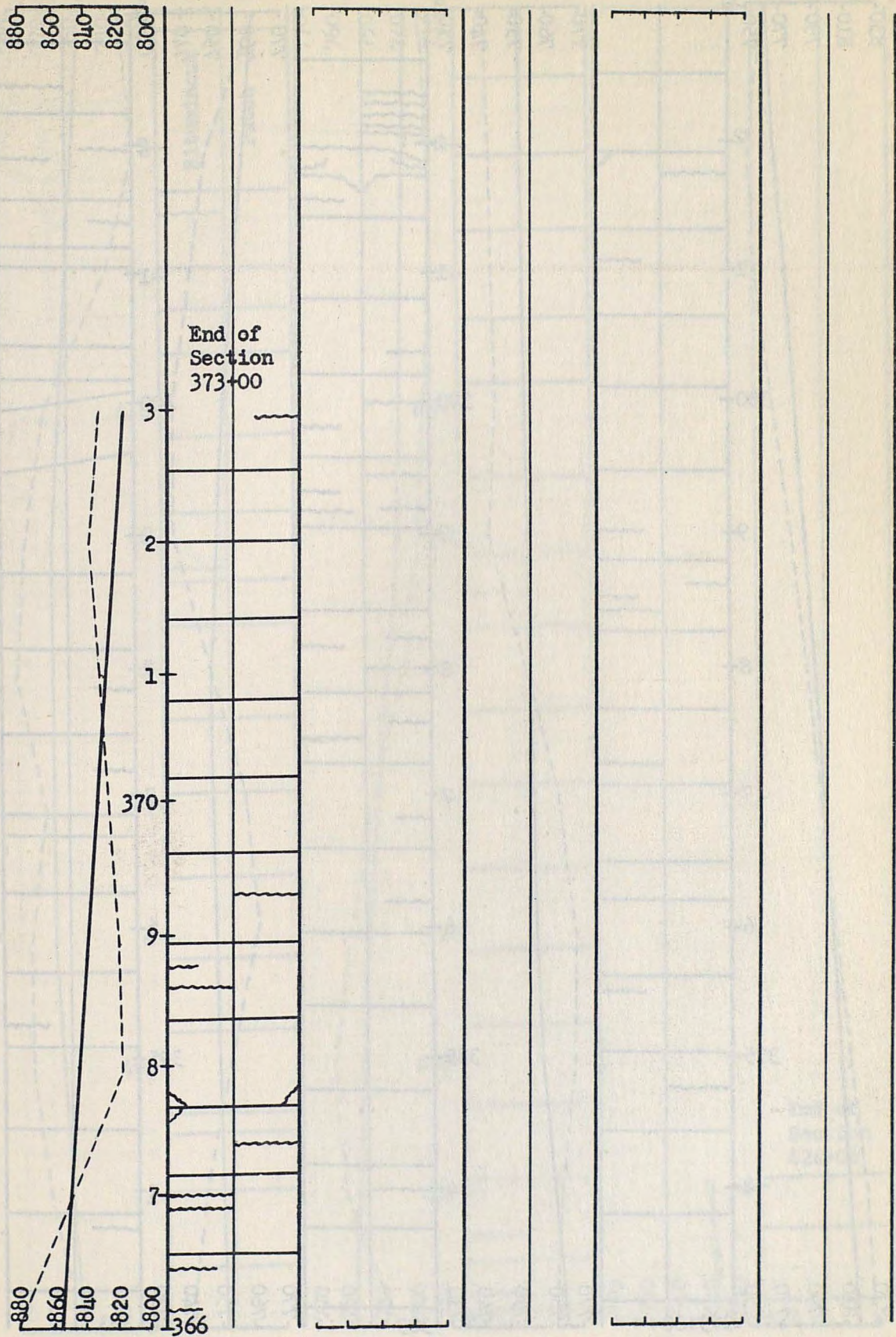
July - August, 1957

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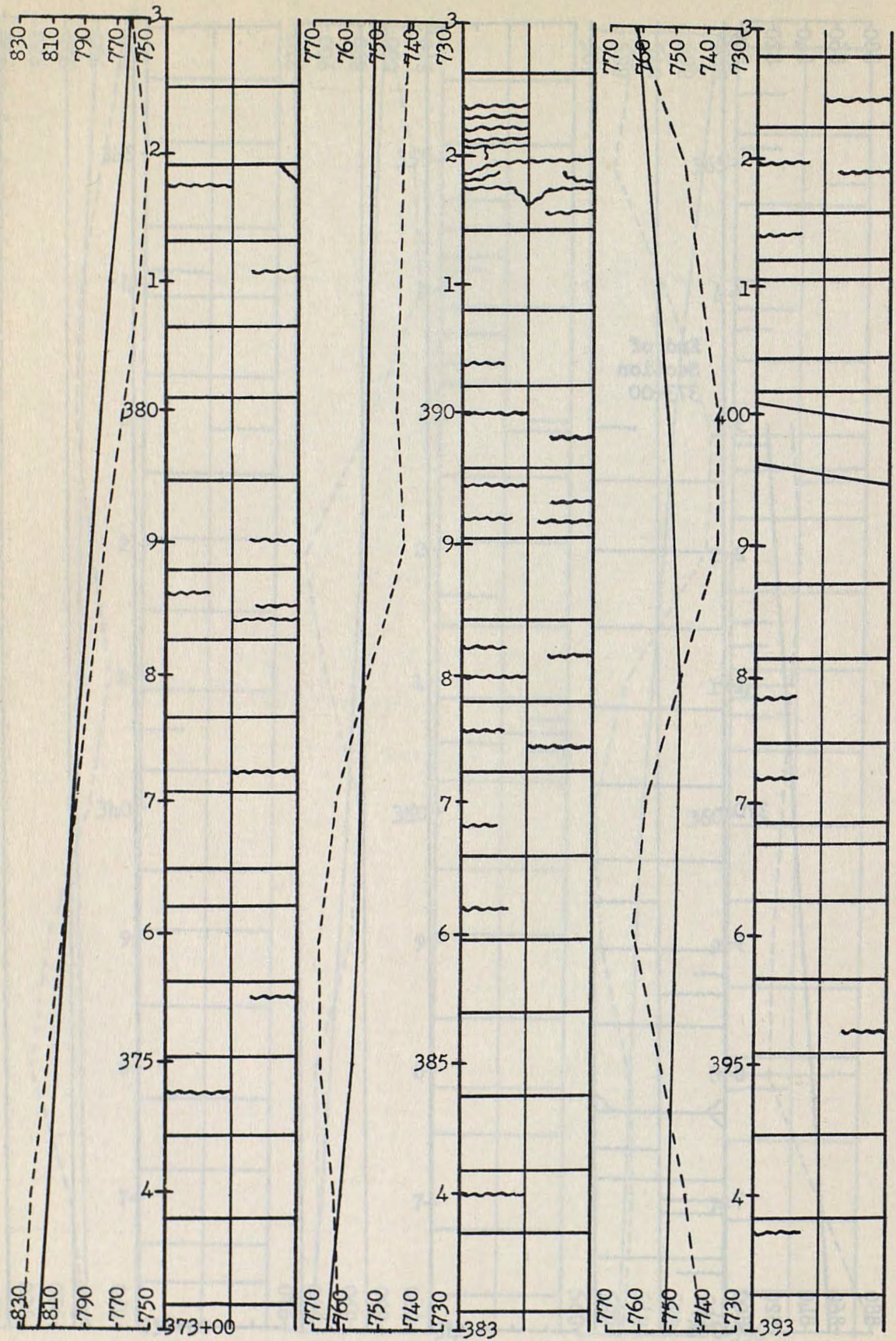
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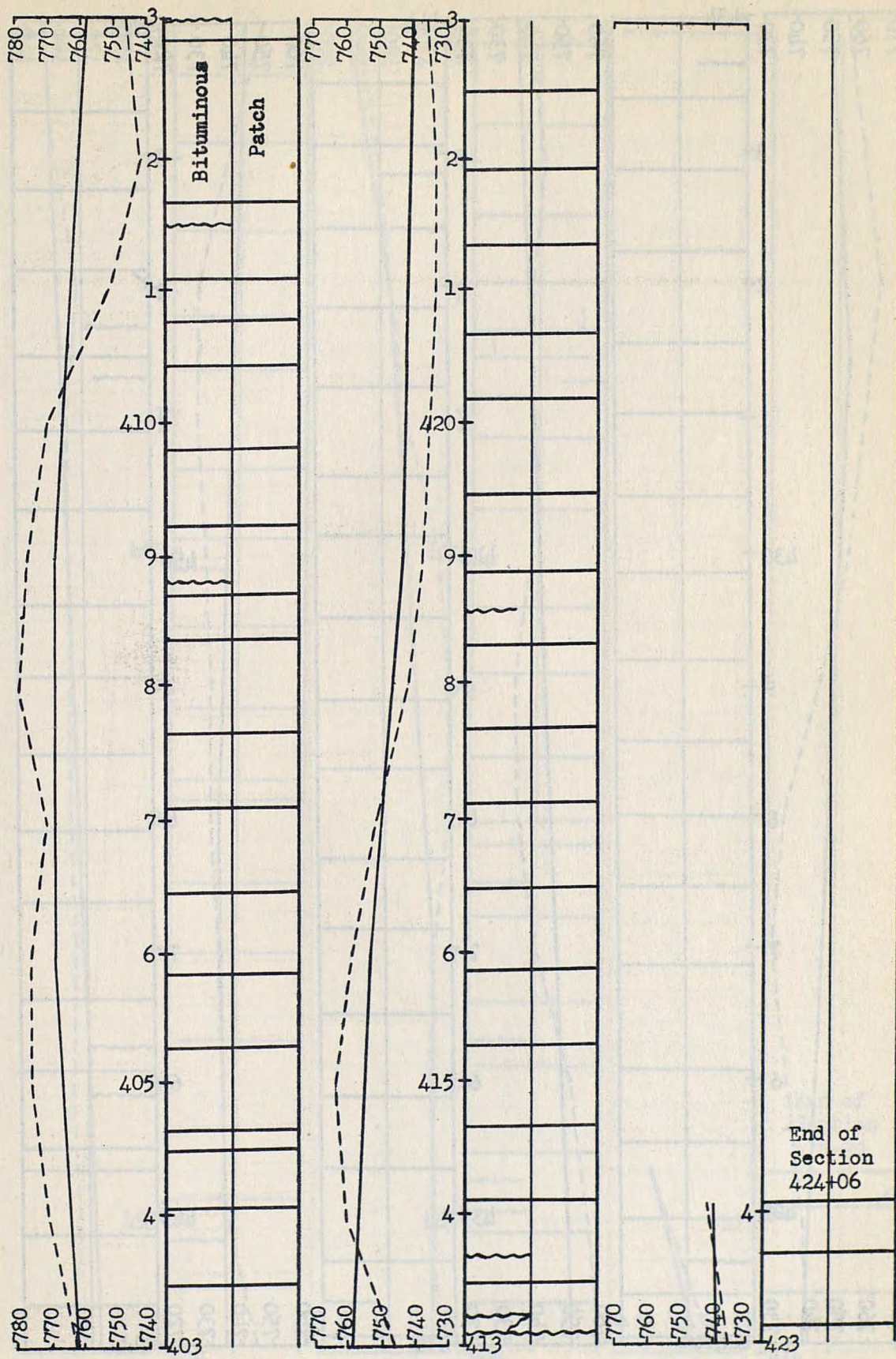
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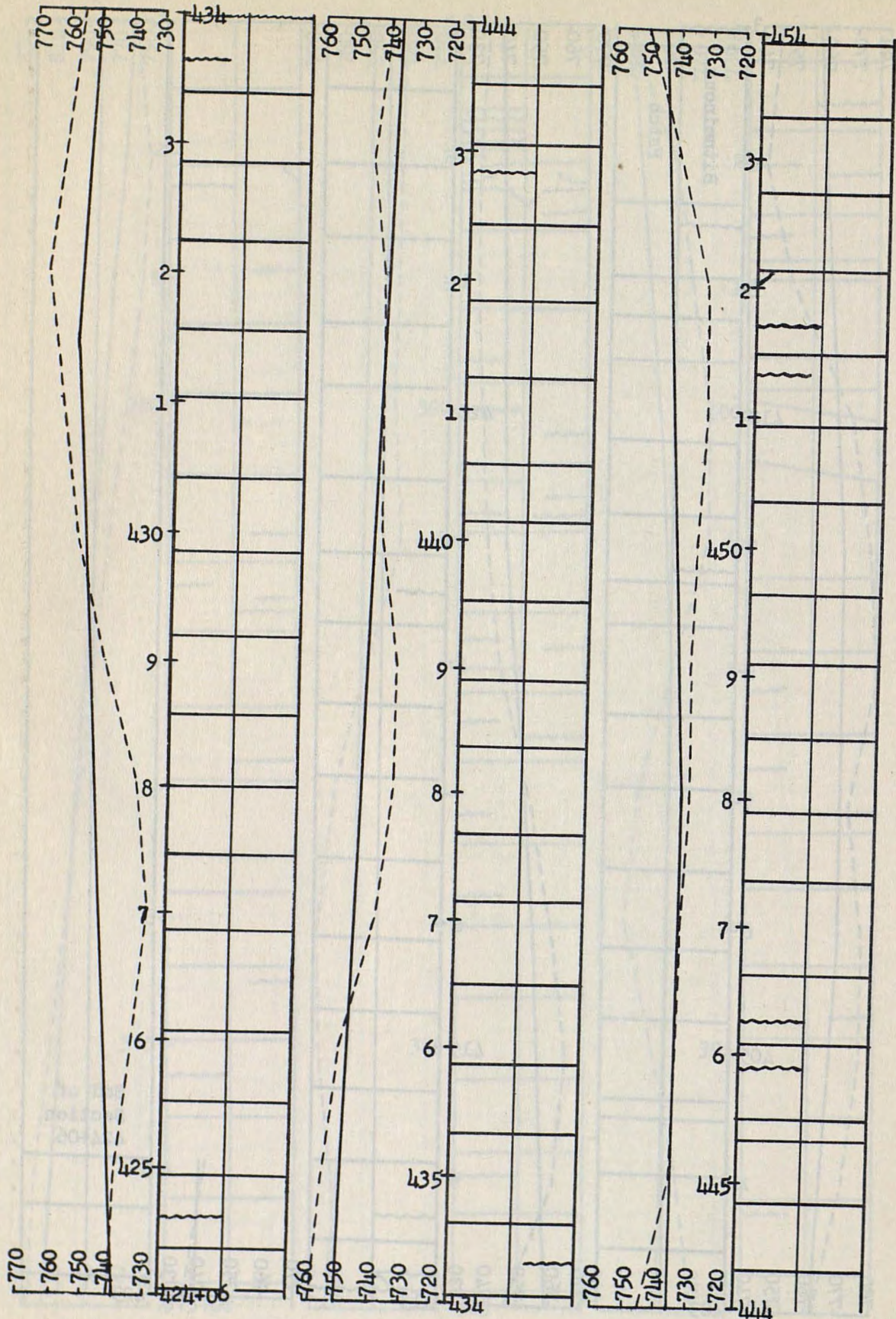
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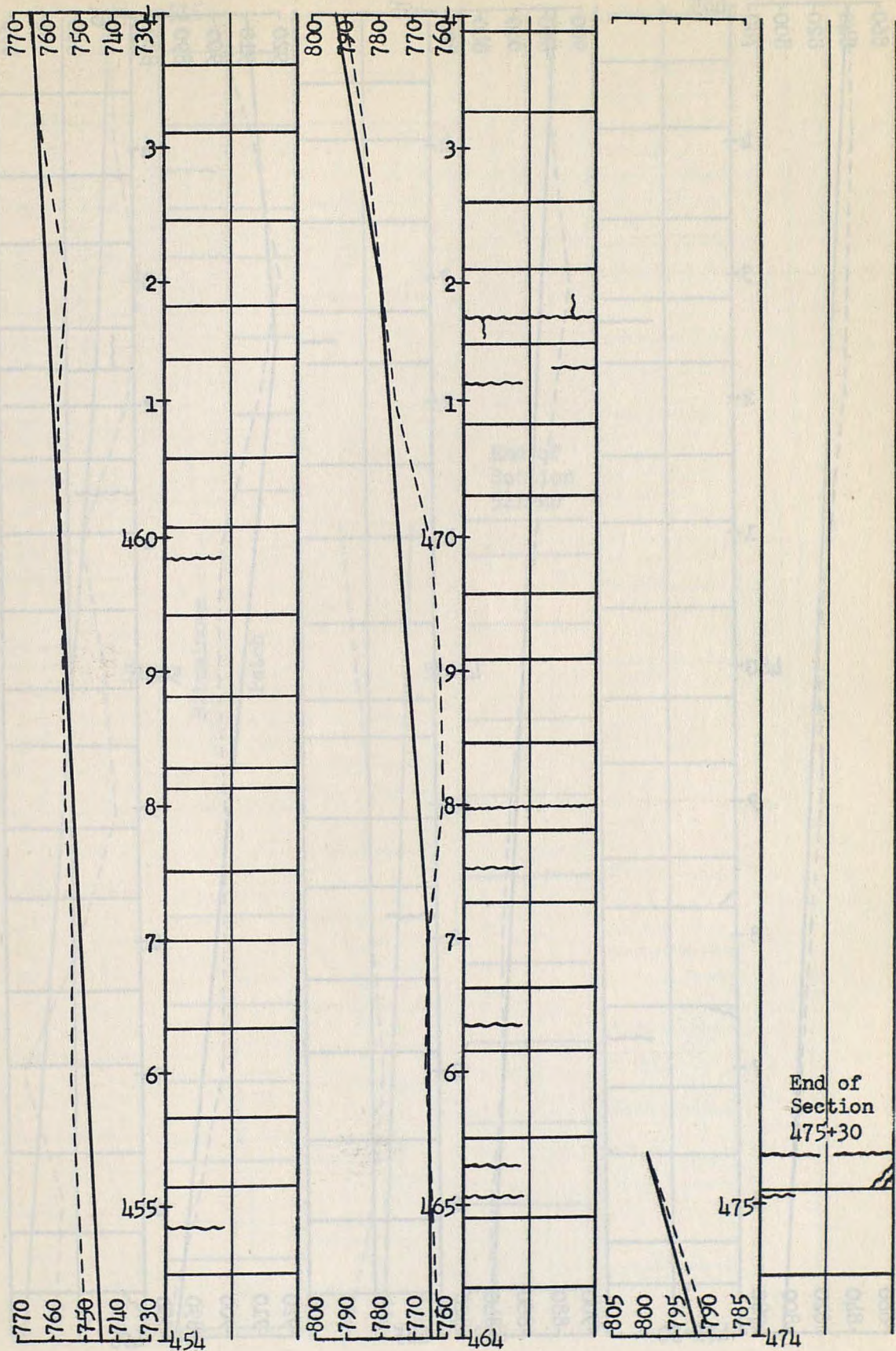
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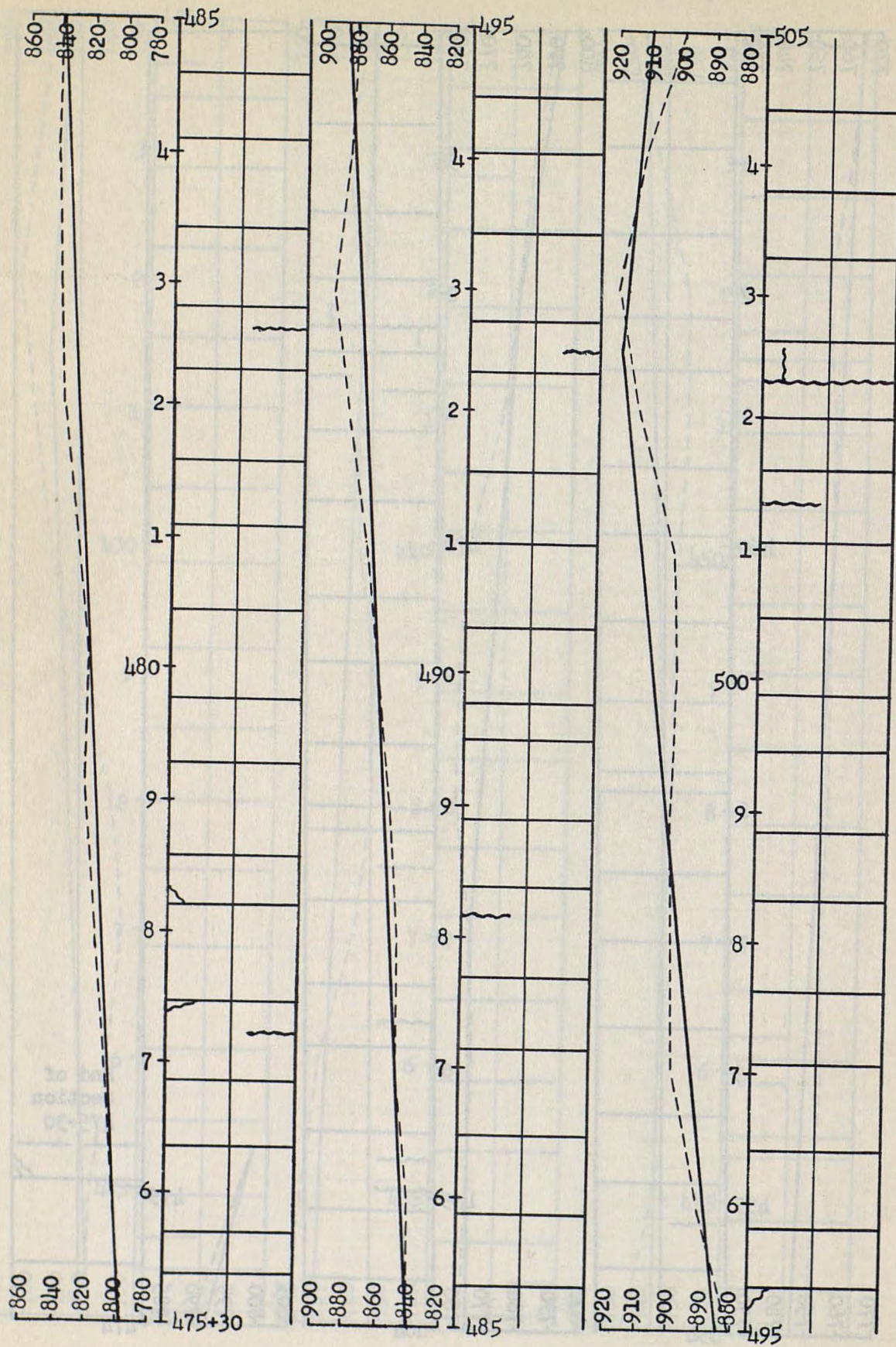
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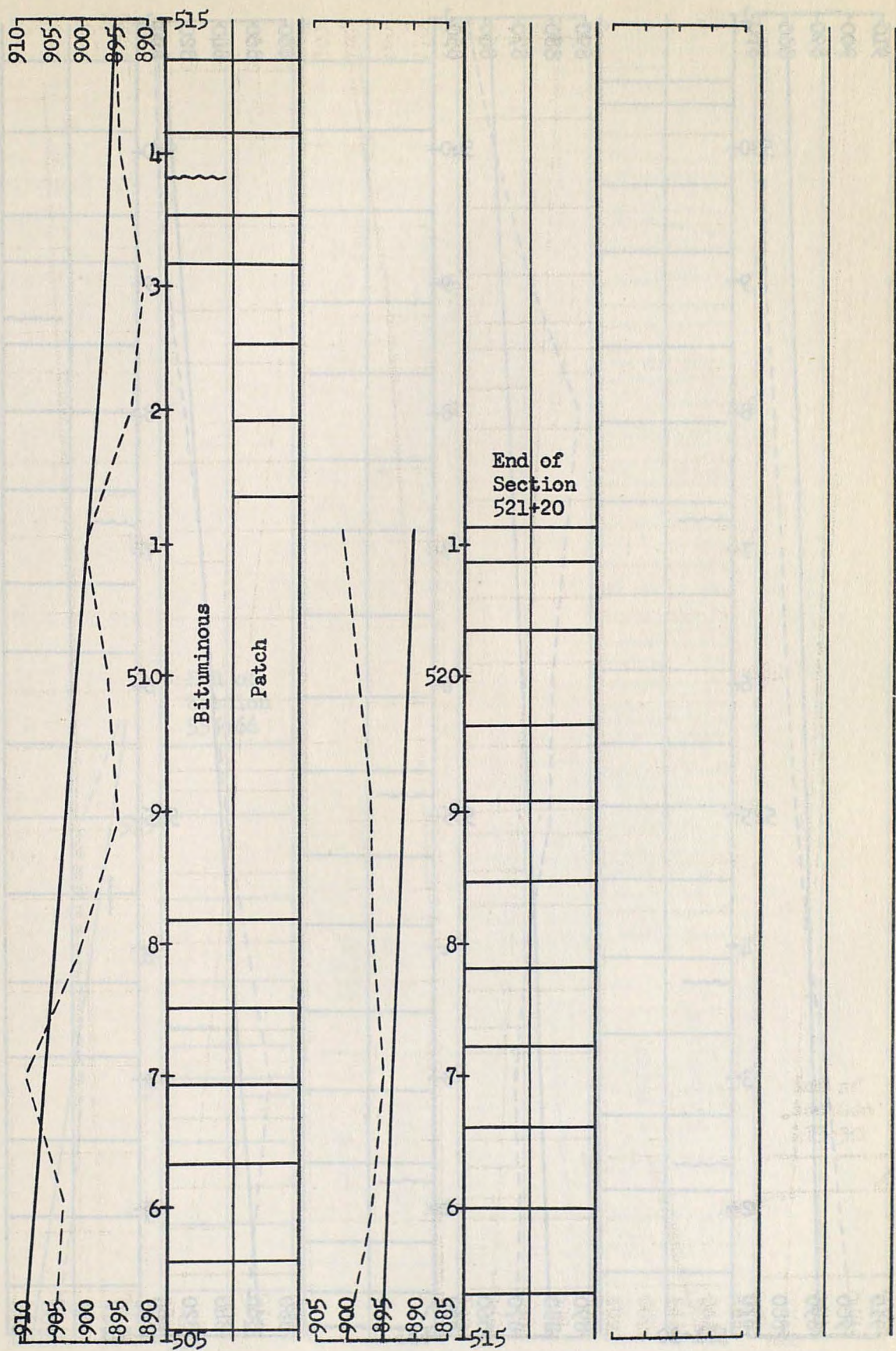
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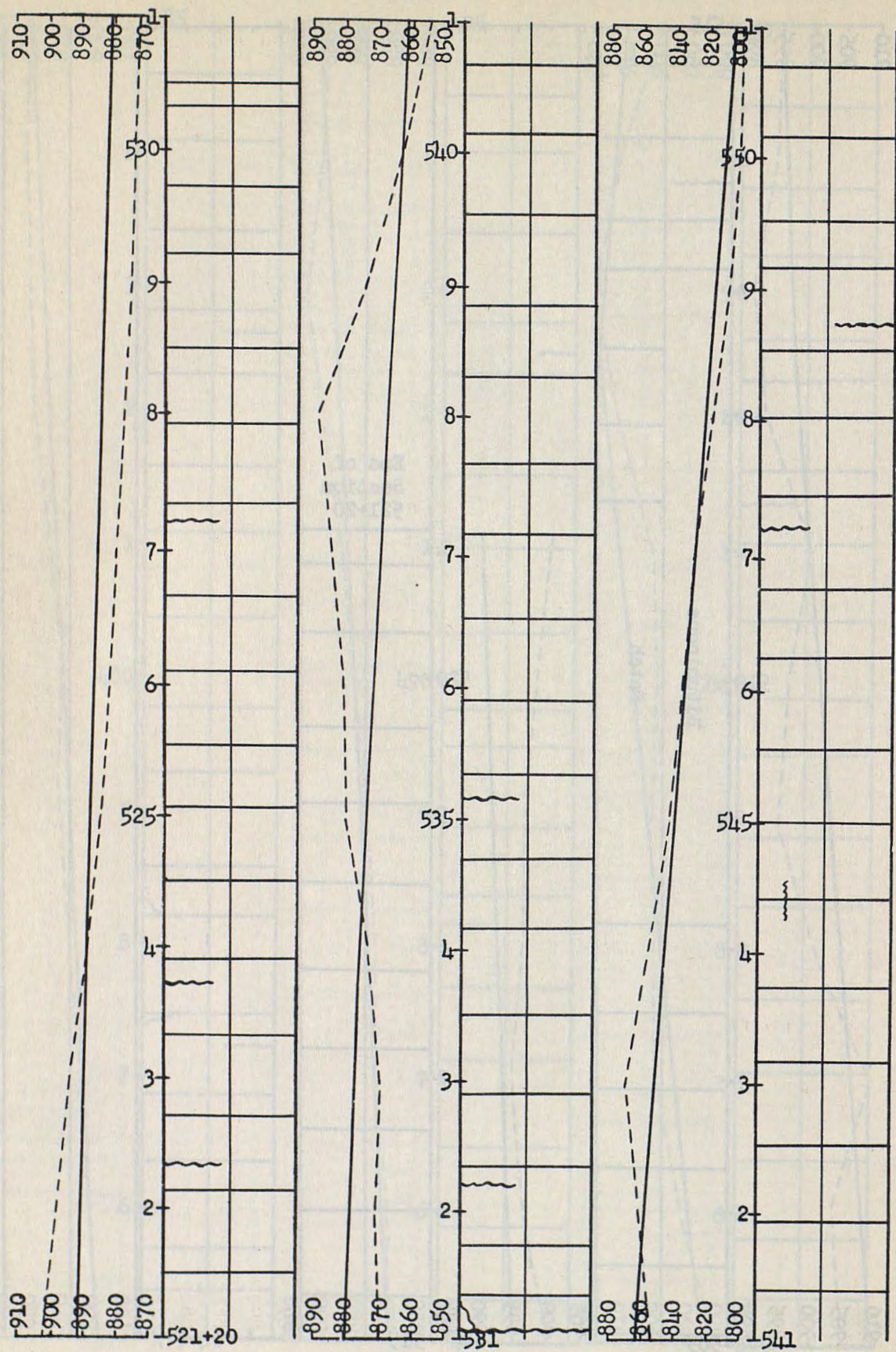
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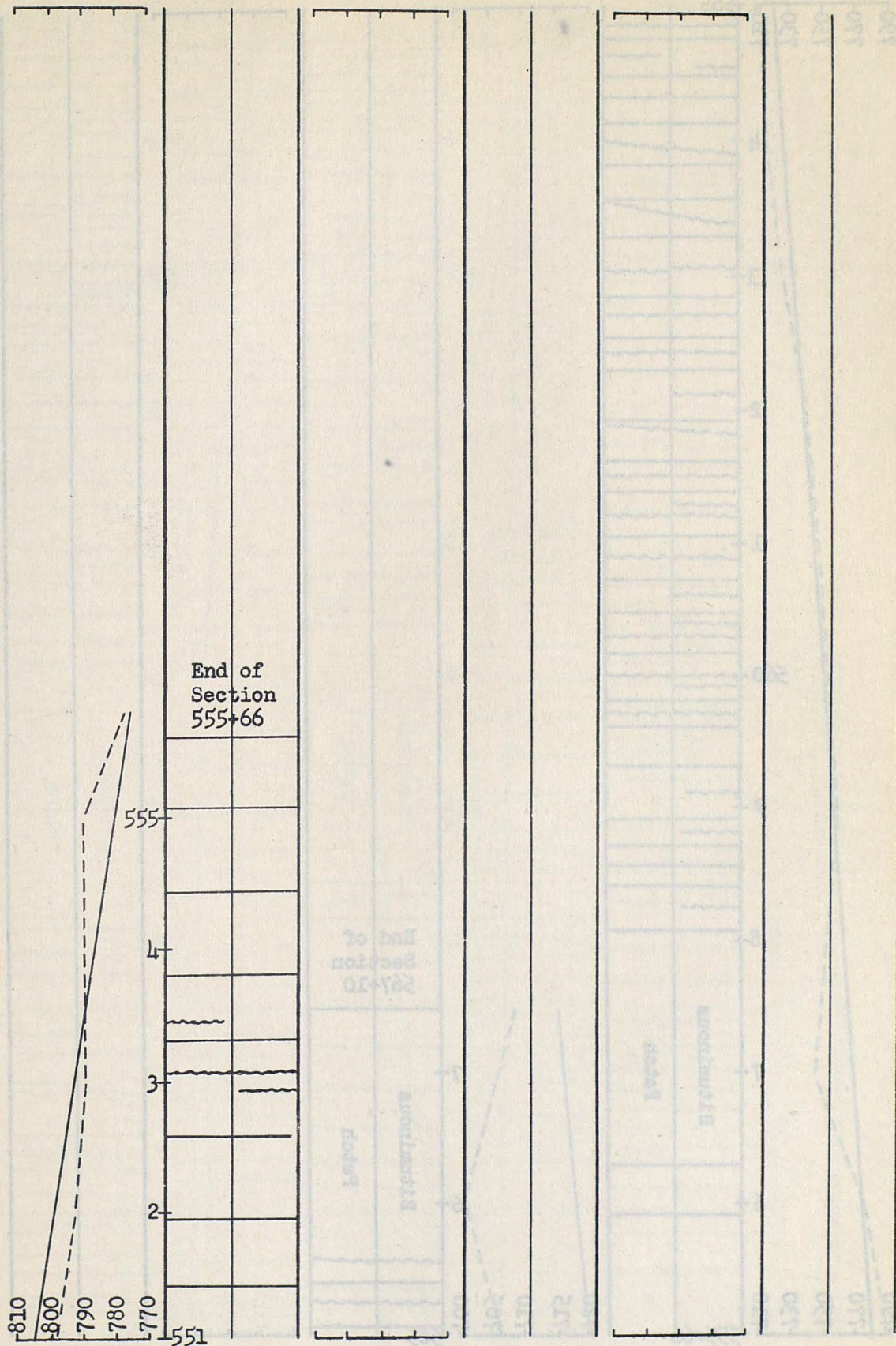
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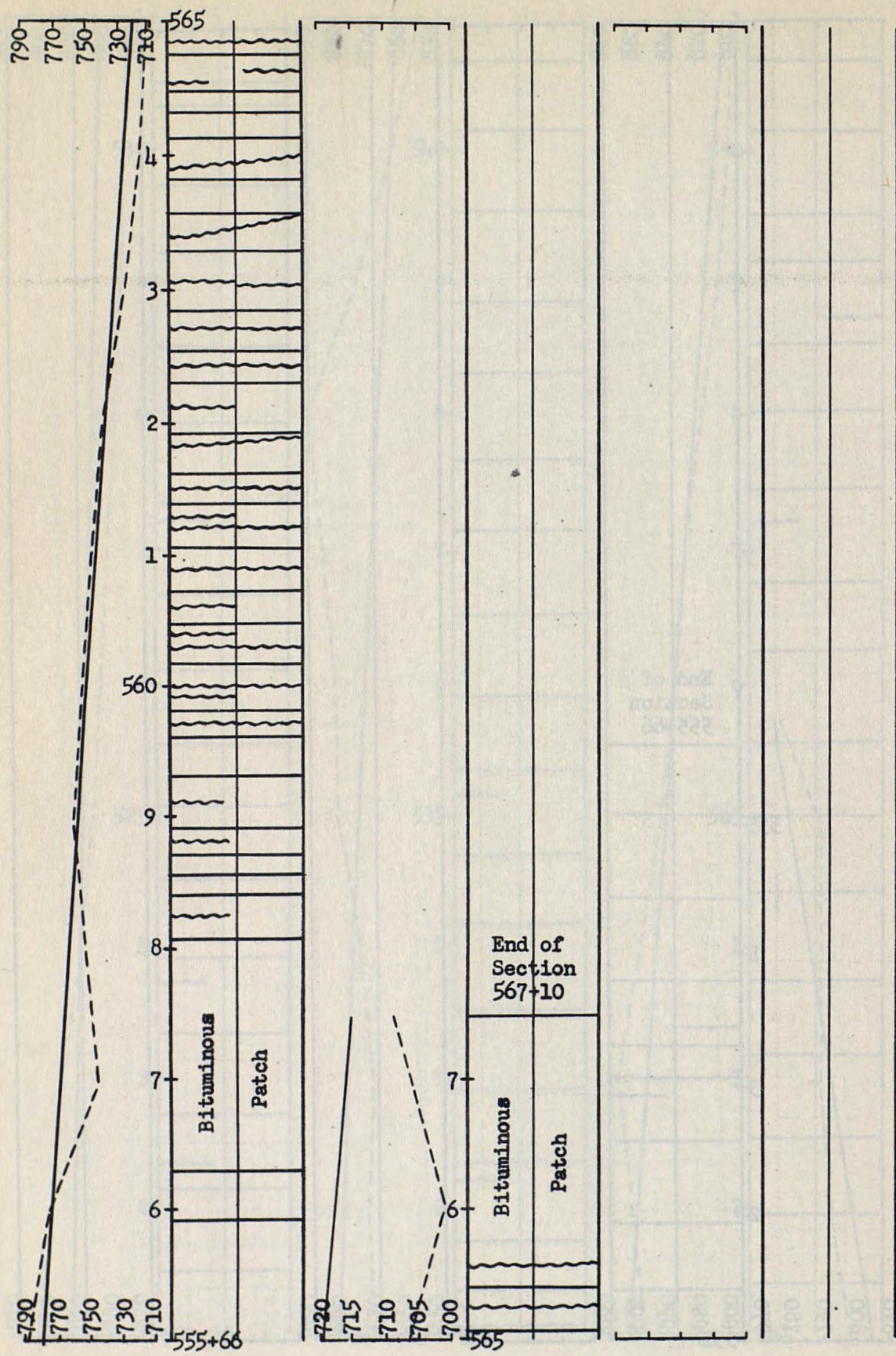
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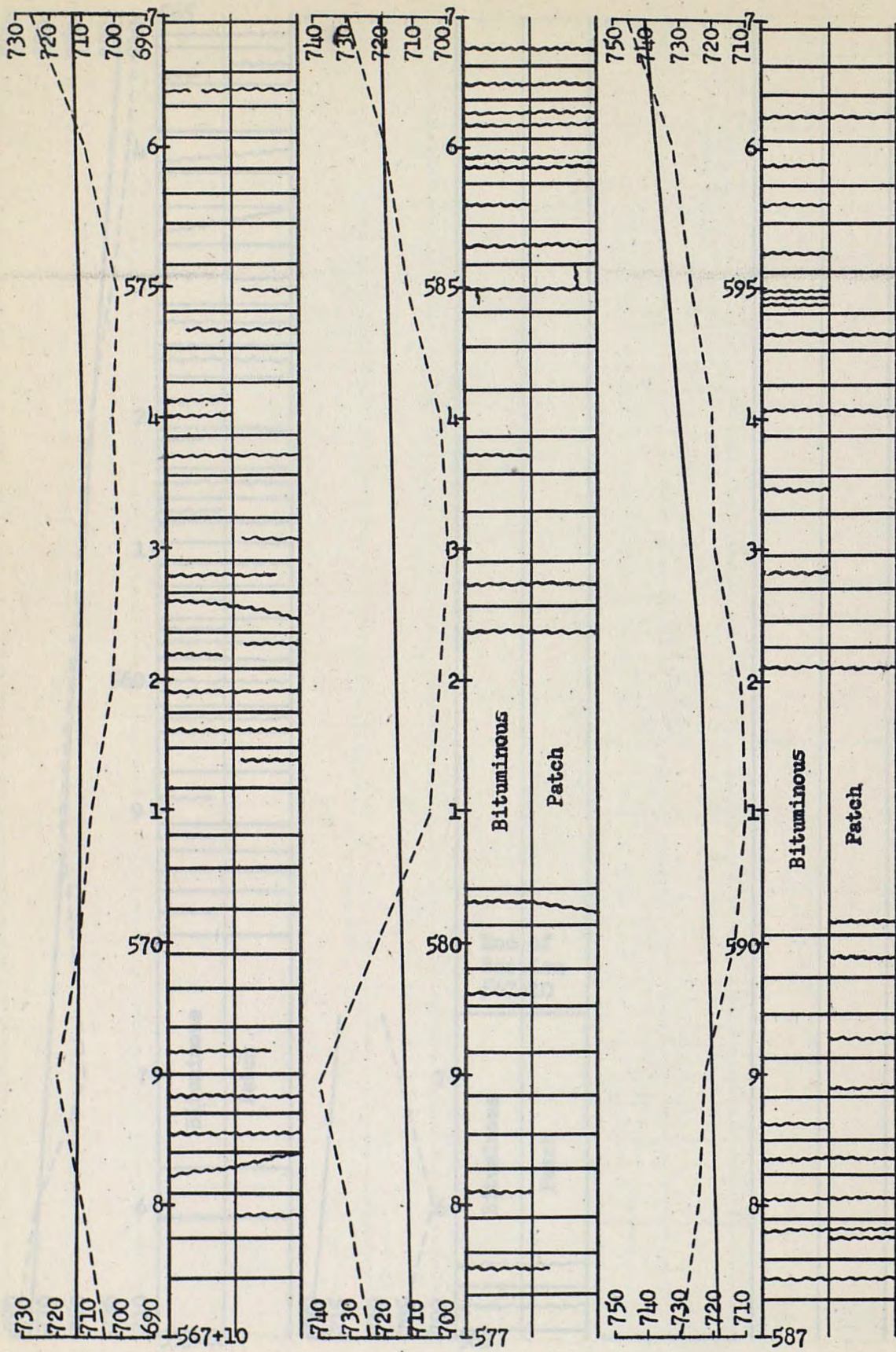
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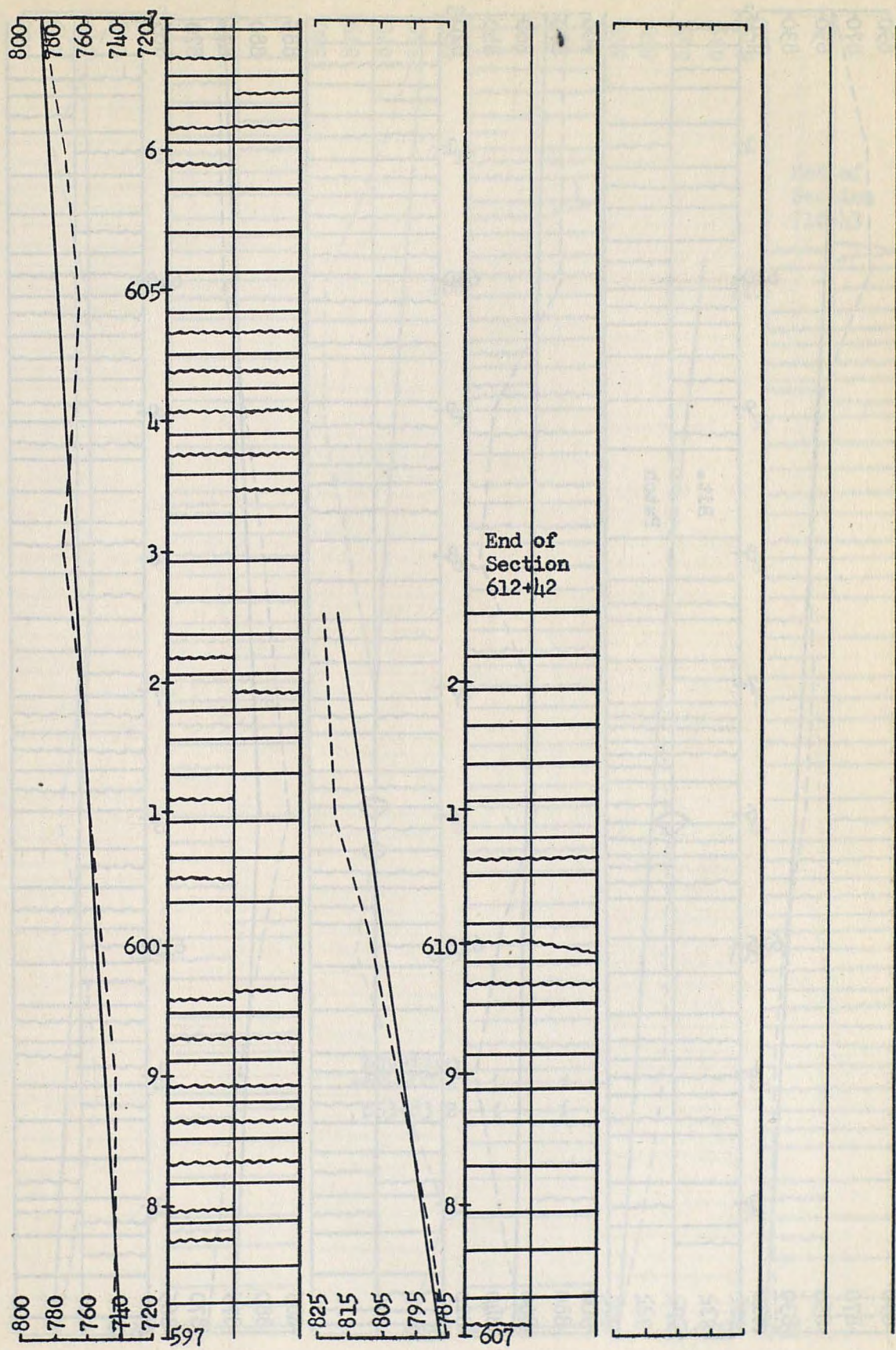
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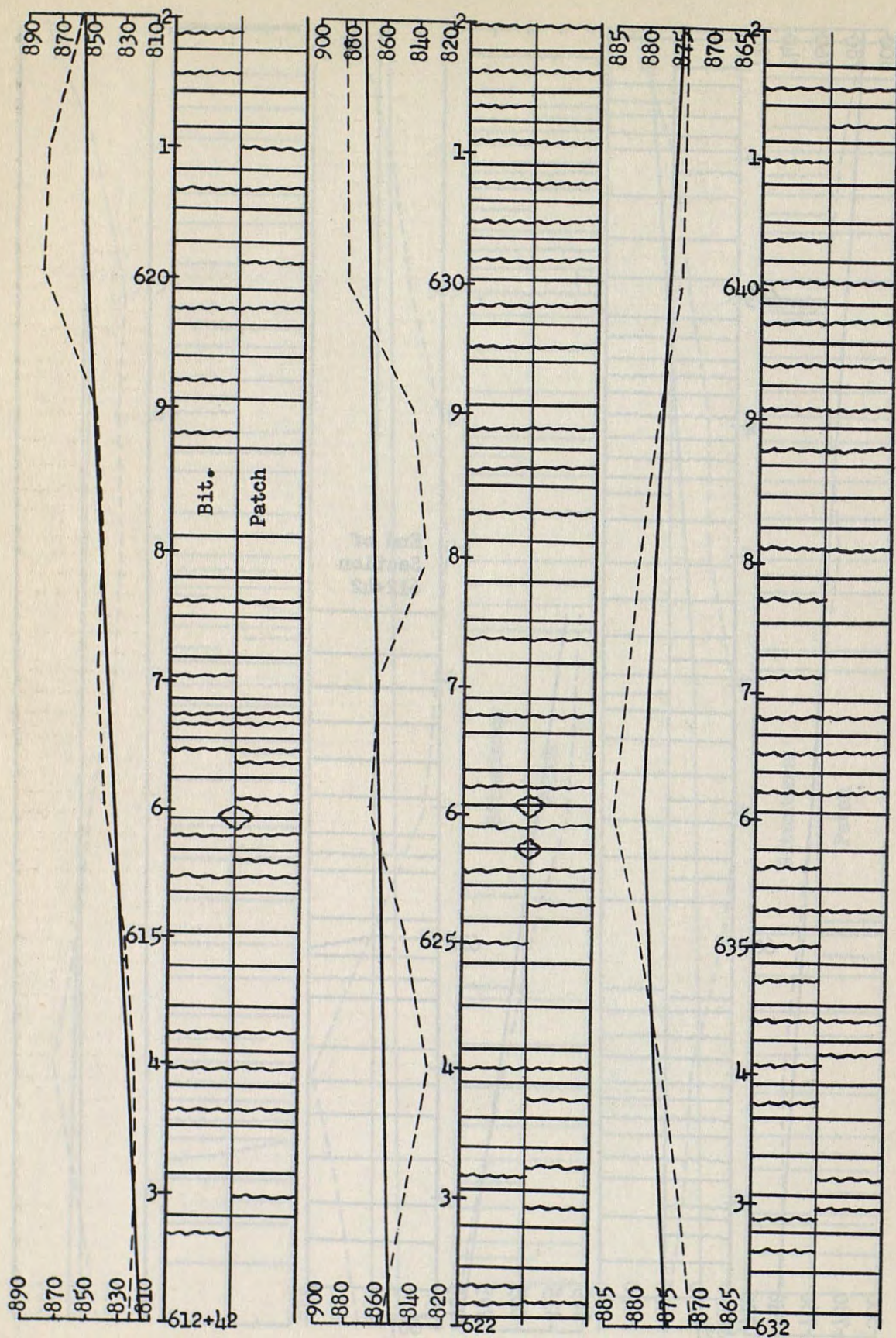
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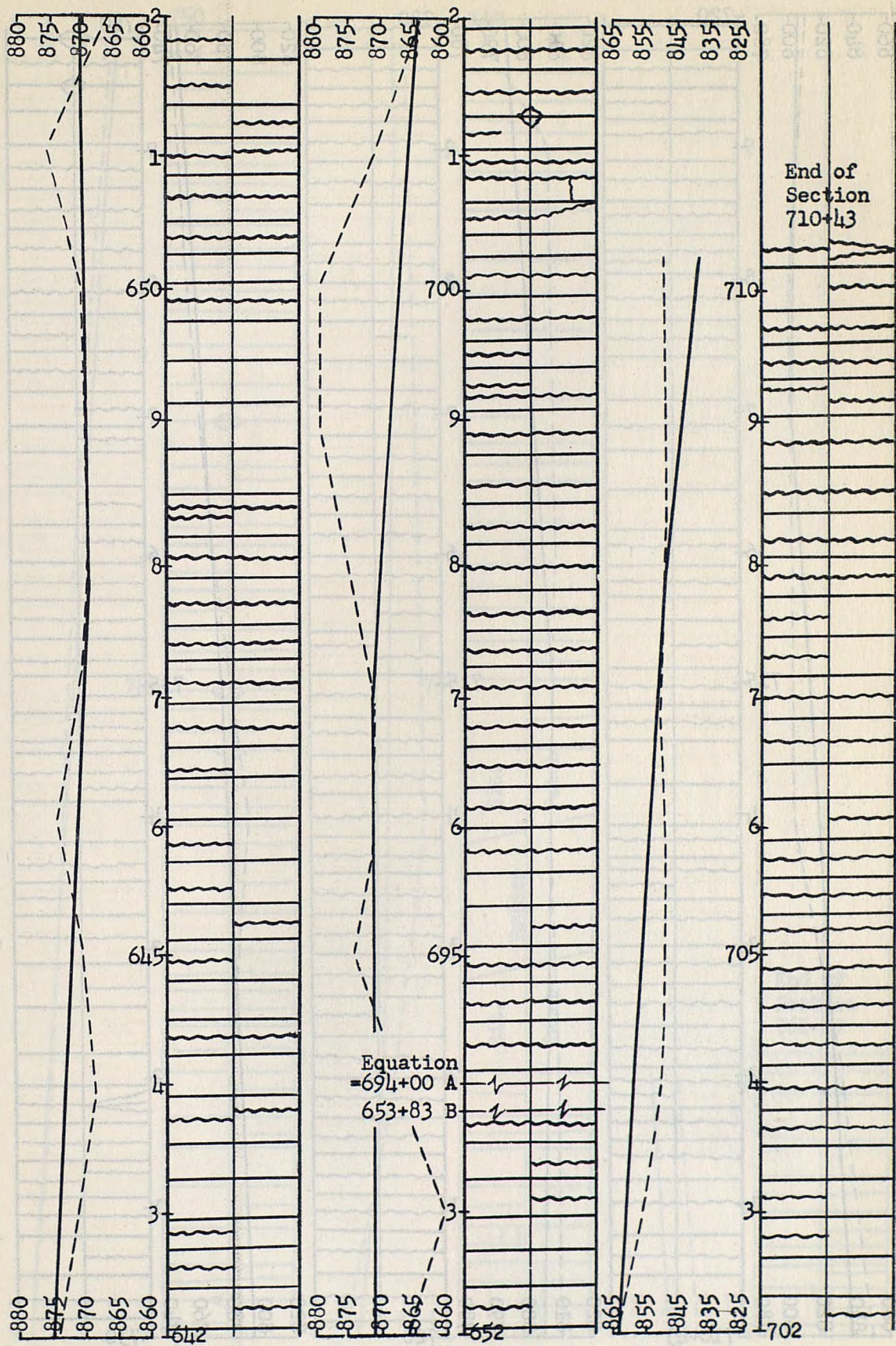
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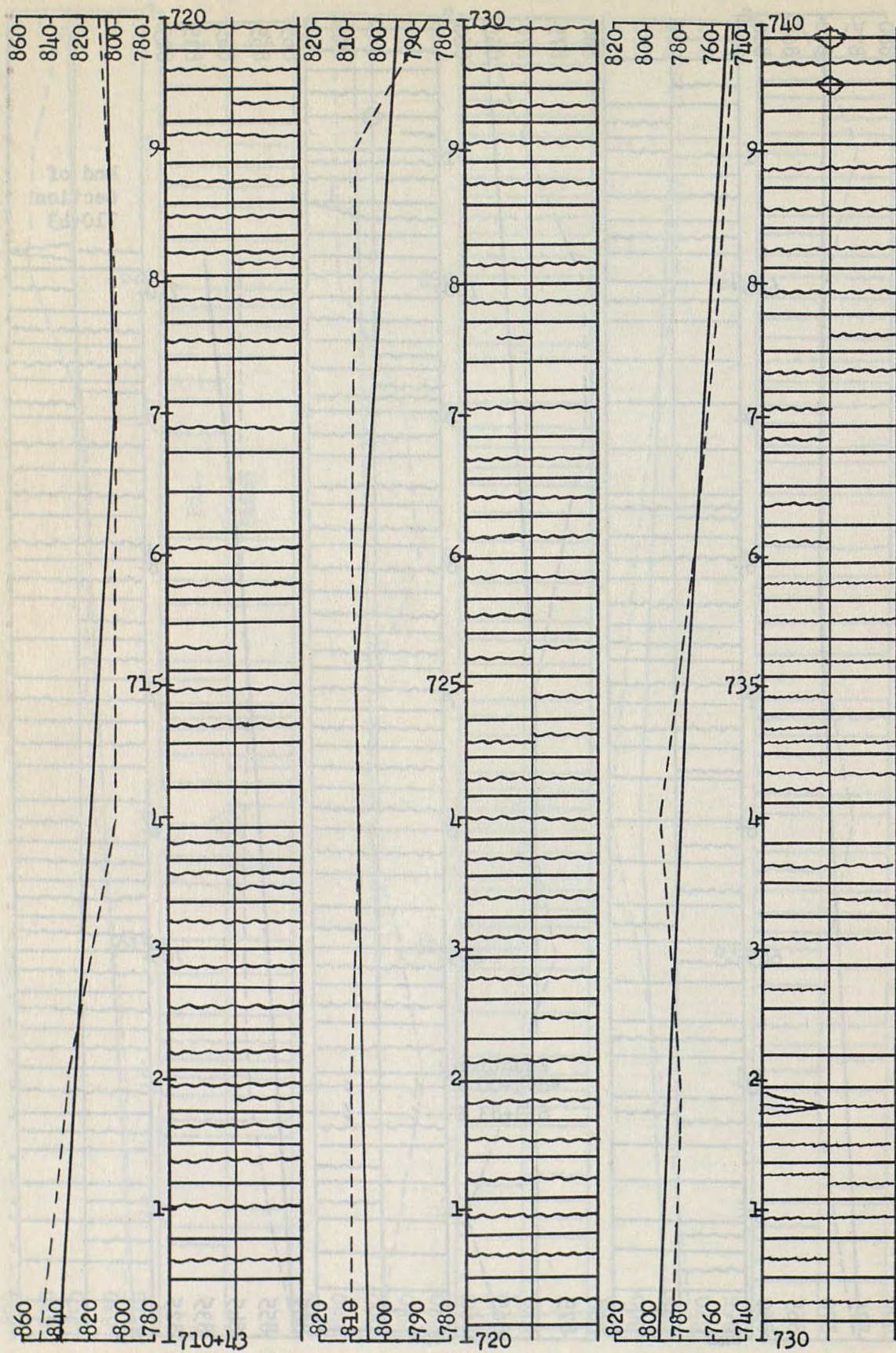
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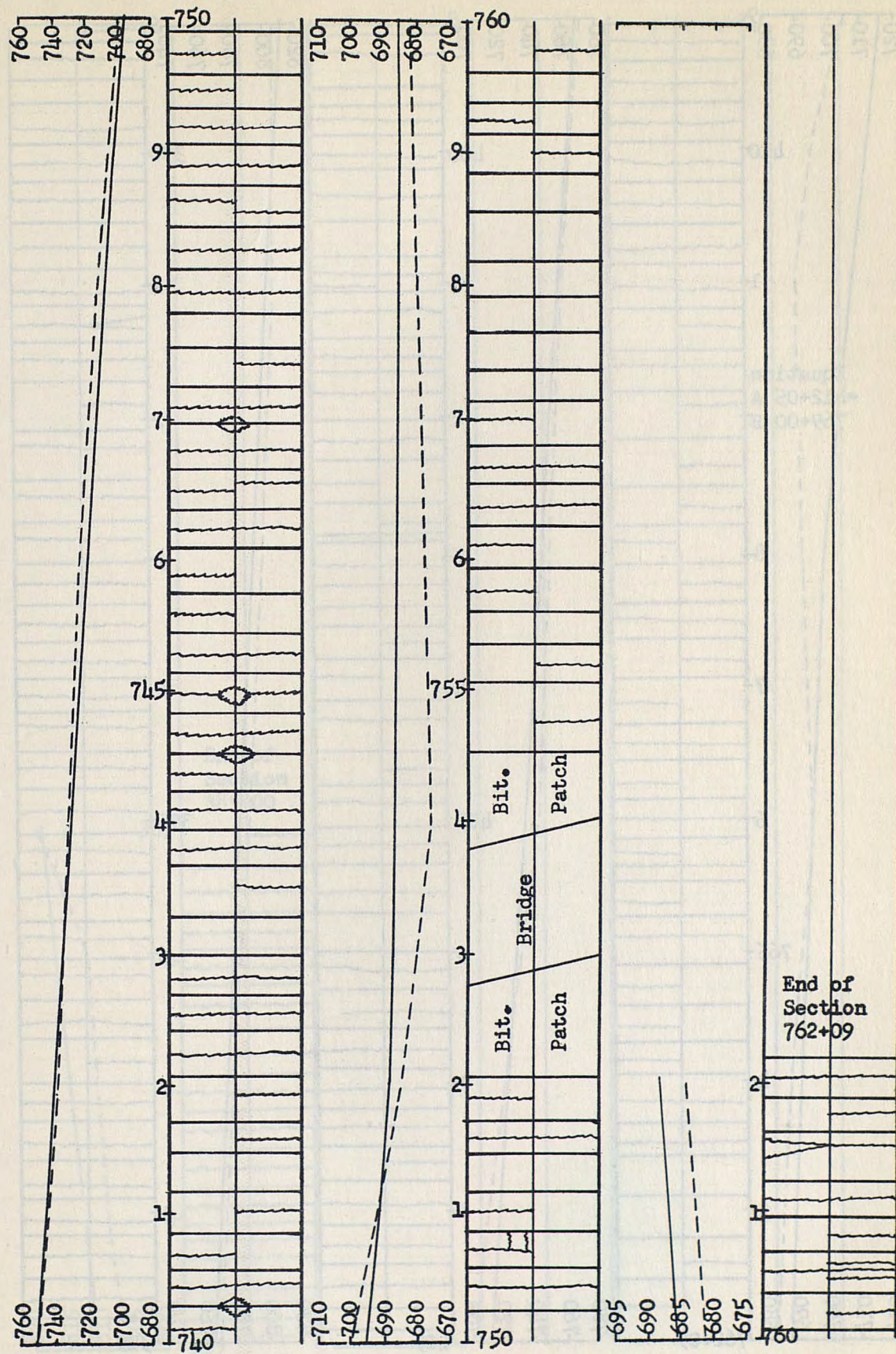
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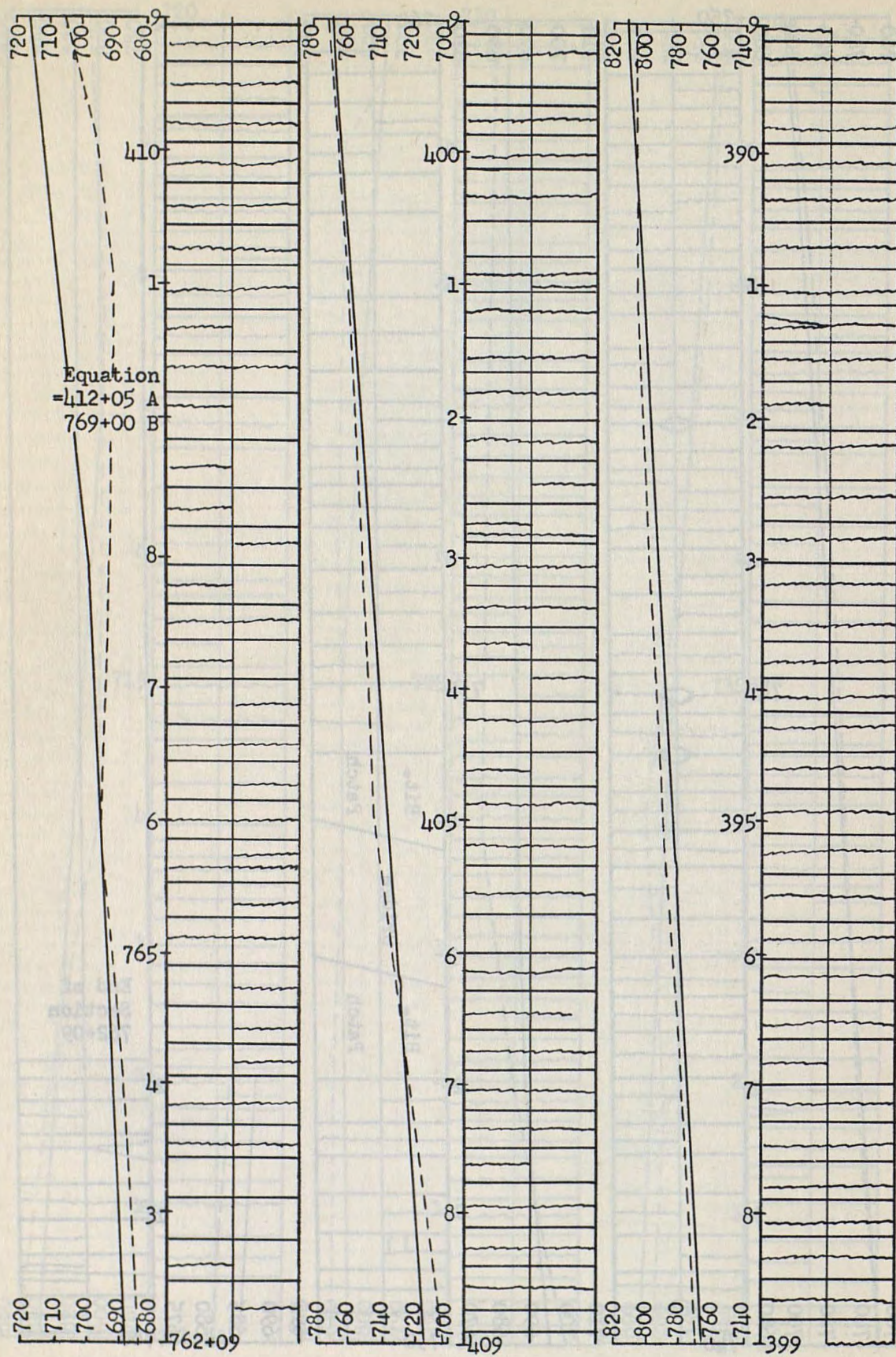
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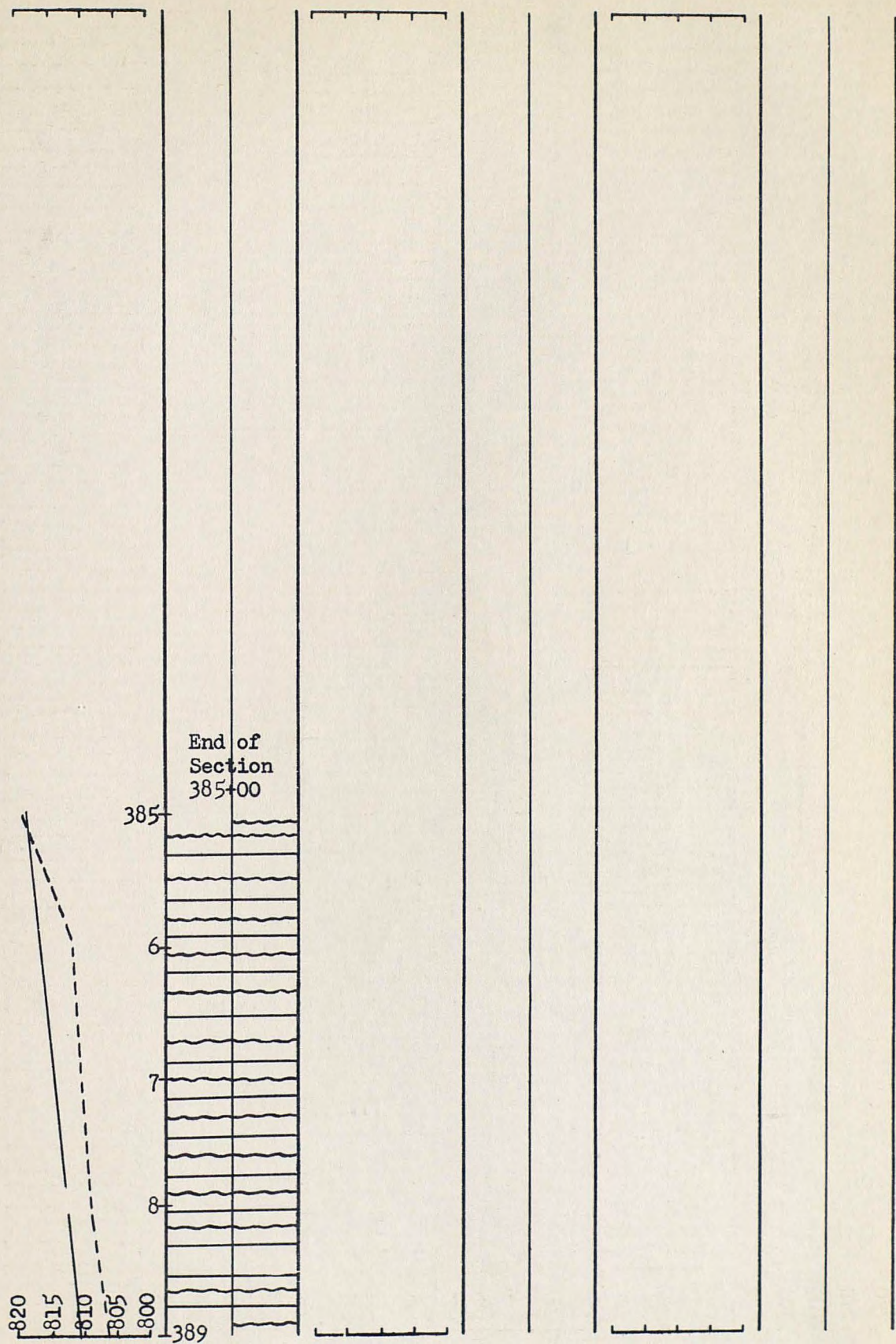
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Section IX



Section X



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