Ground Penetrating Radar Survey of a Cemetery: Interpretation

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Overview

This investigation is appropriate for a class in Applied Geophysics or Geoforensics. It is an interpretation of previously collected GPR data, but it is also appropriate to have the class collect its own data from the site. No software manipulation is involved, although that could also be a second phase in the investigation along with collection and interpretation.

Introduction

This investigation is based on a gridded GPR survey of a cemetery. The data comprise a set of parallel GPR profiles in a square grid system. Profiles were collected both in north-south and east-west directions, but you will be working with only the north-south set.

The objective of the survey is to determine the locations of possible gravesites within the survey grid based on radar characteristics, association with other grave indicators (ground depressions, stone markers), and inference.

The data to work with include:

- Appendix A: The survey grid. Note the symbols for the start and end points of profile lines. Some profiles are broken because of trees on the site.
- Appendix B: GPR profiles. These profiles were collected with a GSSI SIR-3000 system that used a GSSI 400 MHz antenna. The survey was conducted in distance mode. Profile spacing in the north-south data set is 0.2 m. All profiles received the same processing workflow in RADAN software: 6.0 dielectric constant (relative permittivity), time zero offset, and background removal.
- Appendix C: Summary of profile lines, file numbers, and profile endpoint coordinates.

- Research poster: This poster contains additional information about the survey. A sequence of z-sections demonstrates the vertical variability of the entire survey grid. A verified burial is located in File 030. The poster illustrates soil features of the grave shaft, and of artifacts recovered from the bottom of the shaft. Several renditions of migration approximations for the reflection in File 030 are attempts to reconstruct some of the actual dimensions of the anomaly created by this grave.

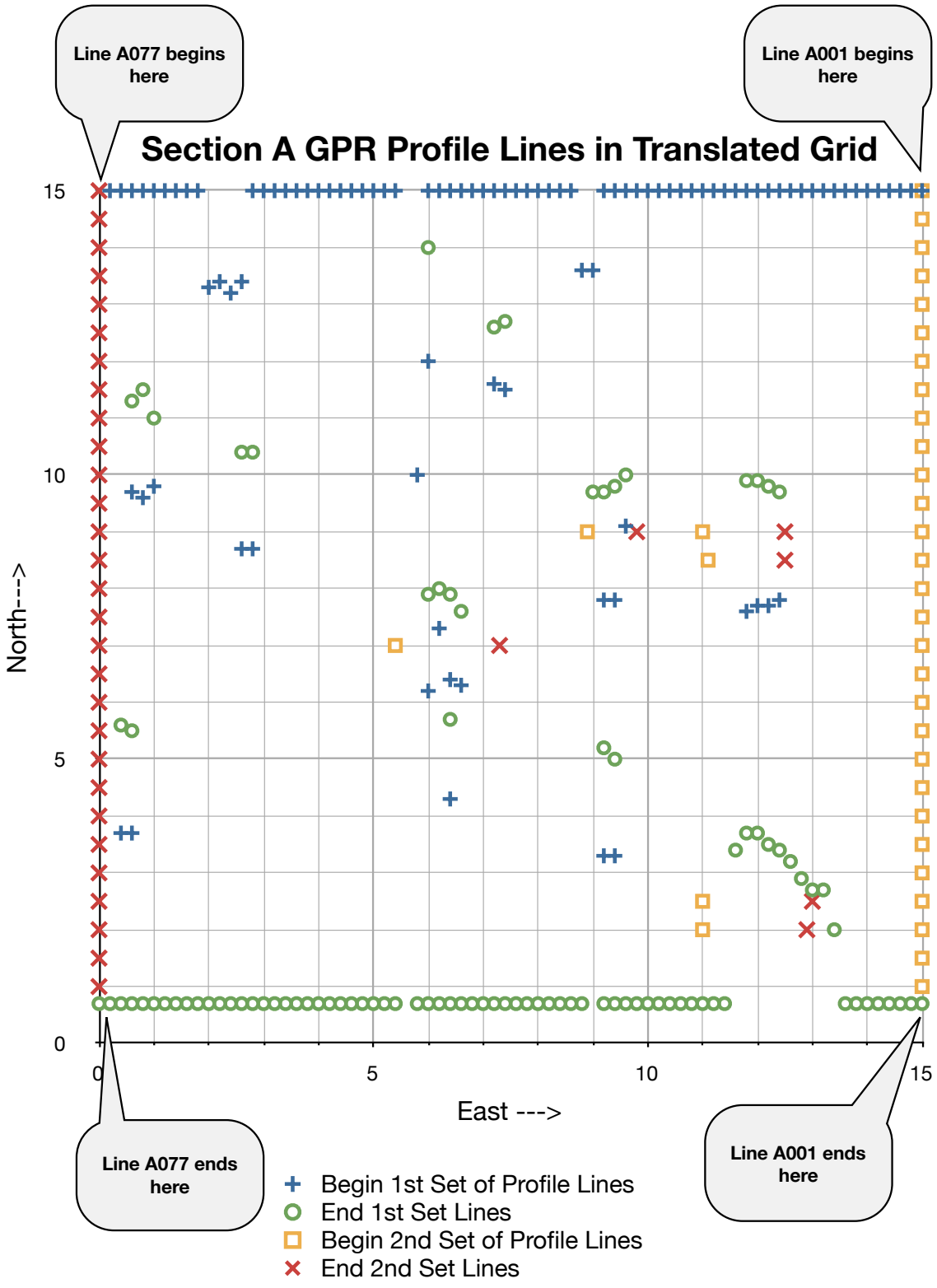
Work through the following goals. Feel free to ask the instructor for hints and explanations.

Goals

1. What is the difference between a cemetery and a graveyard?
2. This cemetery operated from the late 1700s until the late 1800s. The survey site is in a section of the cemetery reserved for "servants". Servants would have been African and African-American slaves and freed slaves. Other indigent members of the community may have also been buried here. There is a separate "members" section of the cemetery for church members. What burial traditions might you expect to find in the survey area that would influence your interpretations of grave locations?
3. What is the most likely orientation of the long dimensions of graves in this cemetery? How would this influence your design of a GPR survey?
4. Study the prominent grave-associated anomaly in File 030 and note its location in the shaded square on the grid map on the poster. Use this anomaly as the epitome *of this particular kind of burial tradition*. Characterize the anomaly with the following features: depth to remains, shape of anomaly, frequency properties, symmetry or asymmetry of the anomaly, and relationship of the anomaly to characteristics of surrounding soil and saprolite radar properties. Include other criteria as appropriate.
5. What must you consider in determining whether the epitome anomaly accurately represents a standard reflection for this burial tradition?
6. Evaluate each of the radar profiles for the presence of graves using established reference criteria. Record the x, y, and z coordinates of each grave. Place a mark on the grid map for each grave you identified.
7. Are there other point anomalies in the survey site besides potential graves? If yes, compile identification criteria and see if you can collect them in unique groups. Describe what objects you think each of your groups might represent.
8. Are there any planar reflectors in this survey? If so, similarly characterize them in groups by depth, extent, orientation, and frequency properties. Can you distinguish instrumental noise from true planar reflectors? How?
9. Write a brief summary of your workflow and overall results.

Report

Prepare a written report that addresses each of the previous goals. Include your summary in this report.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Section A GPR Profile Lines in Translated Grid
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Line A001 ends here
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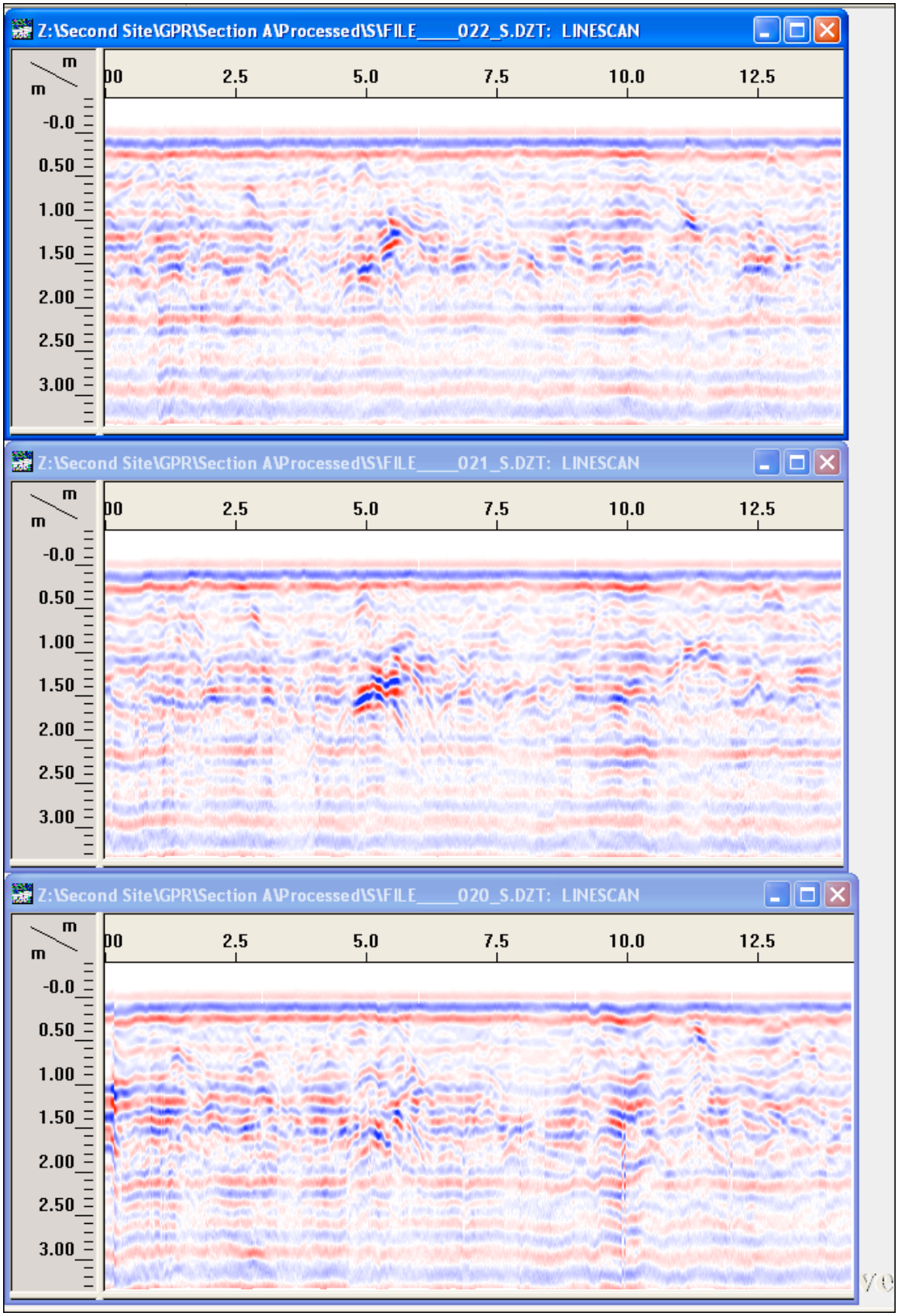
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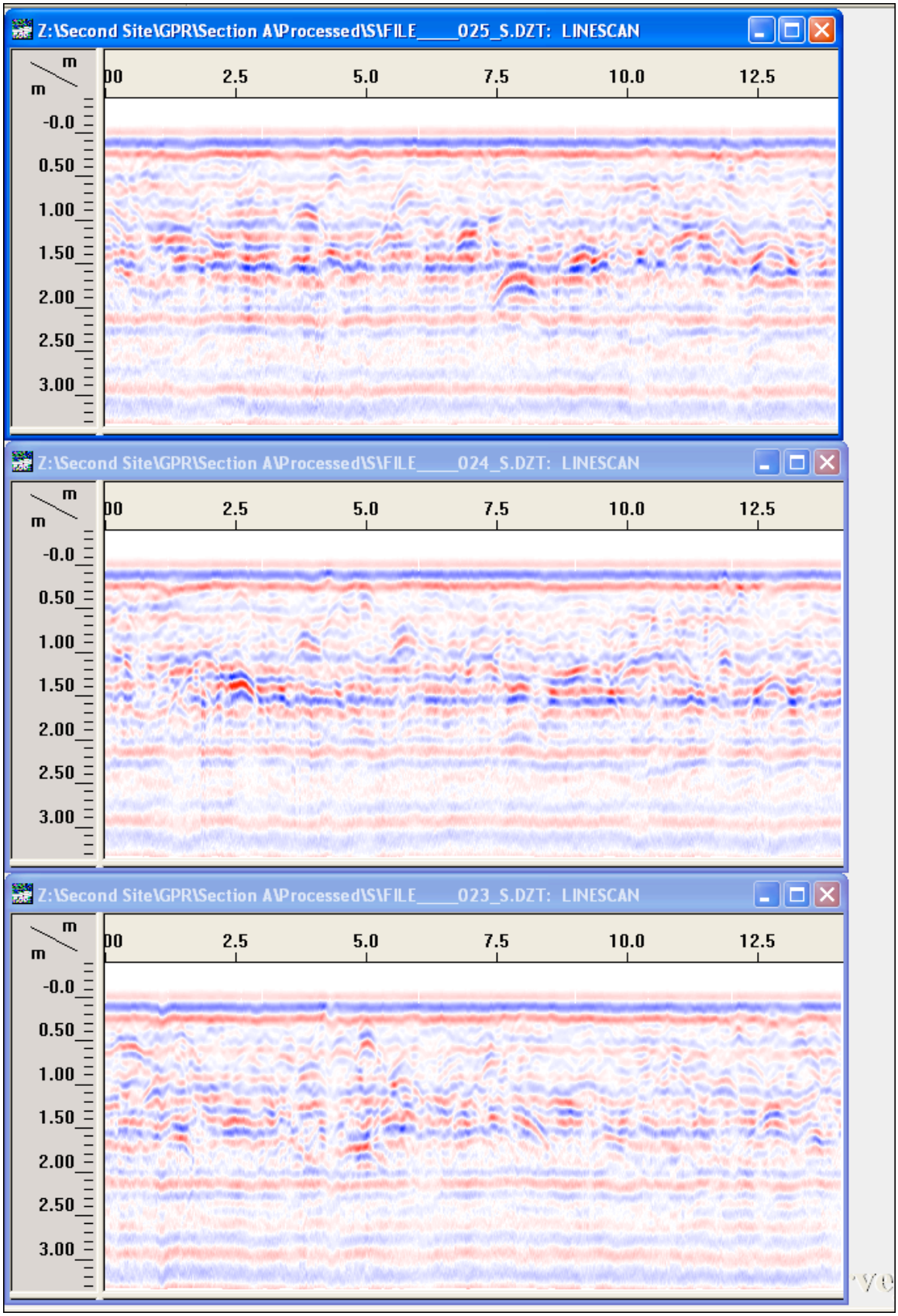
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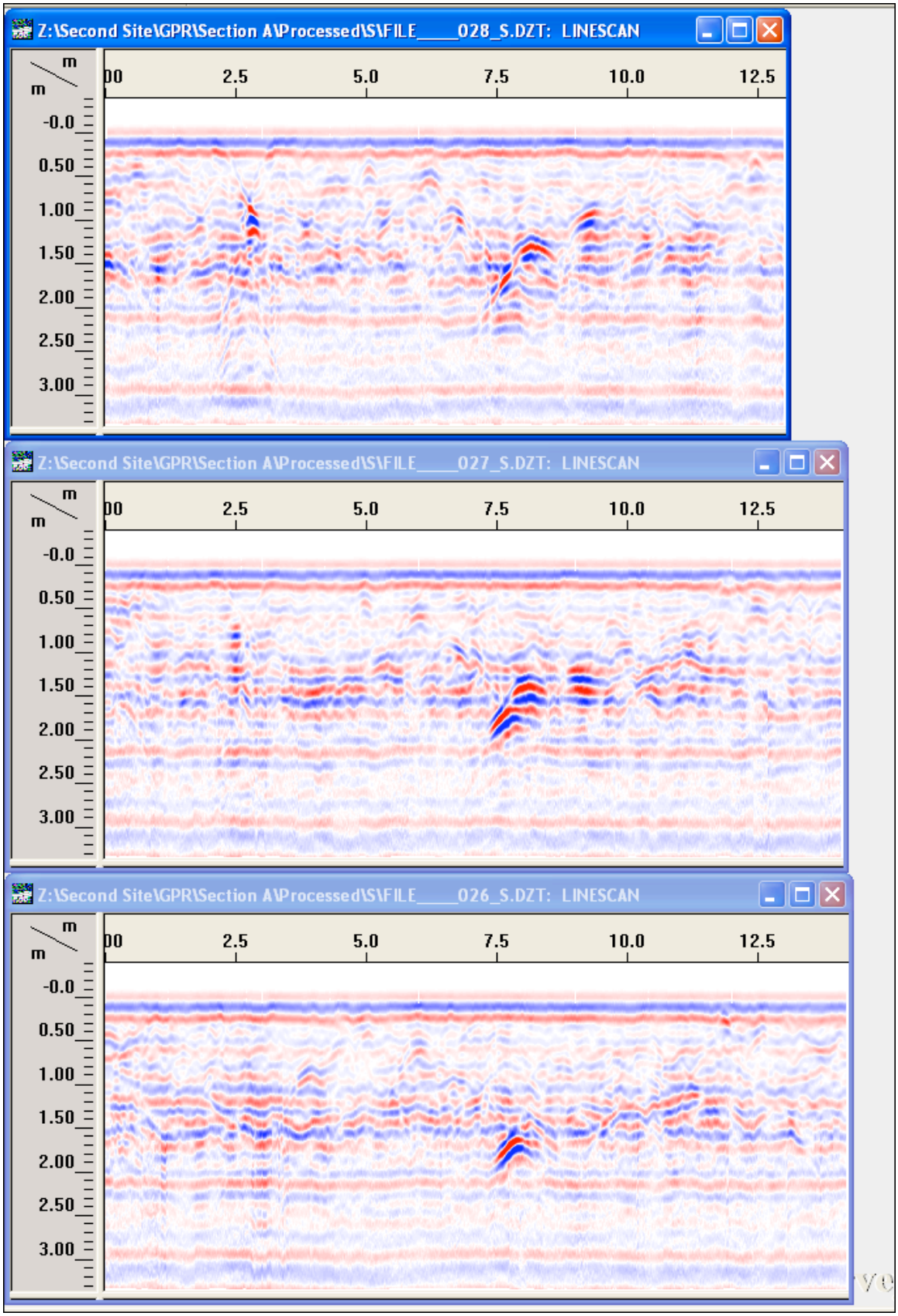
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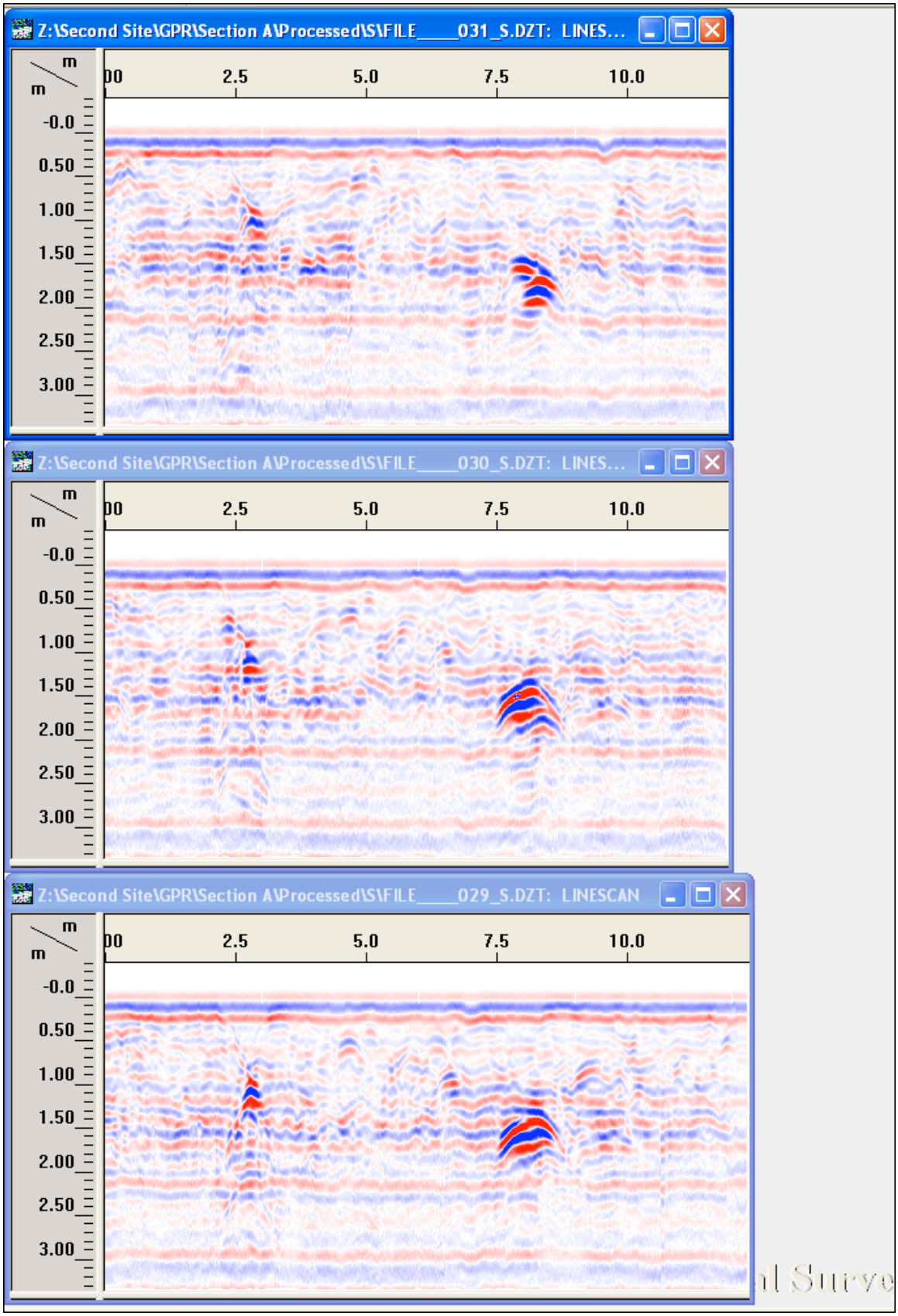
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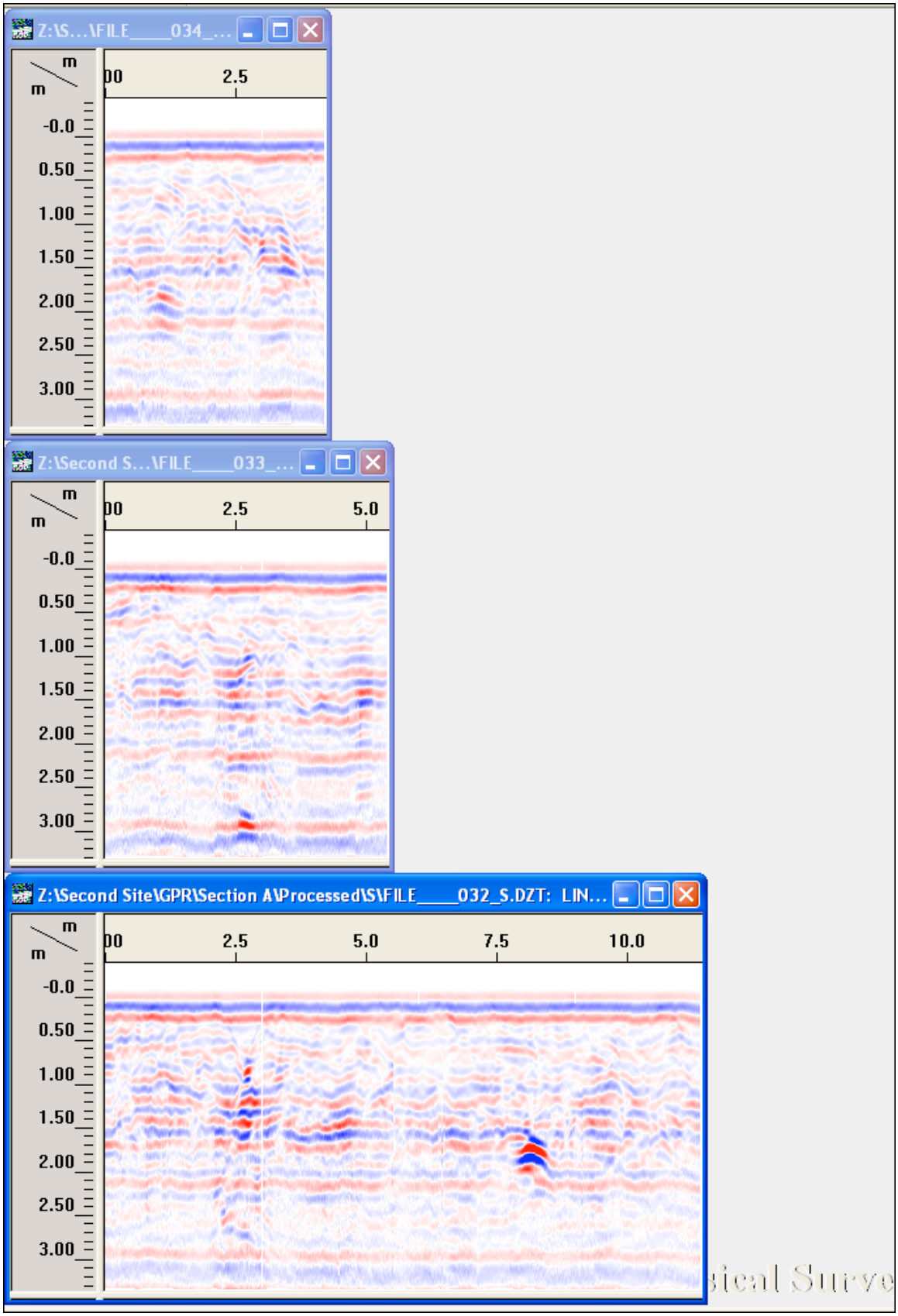
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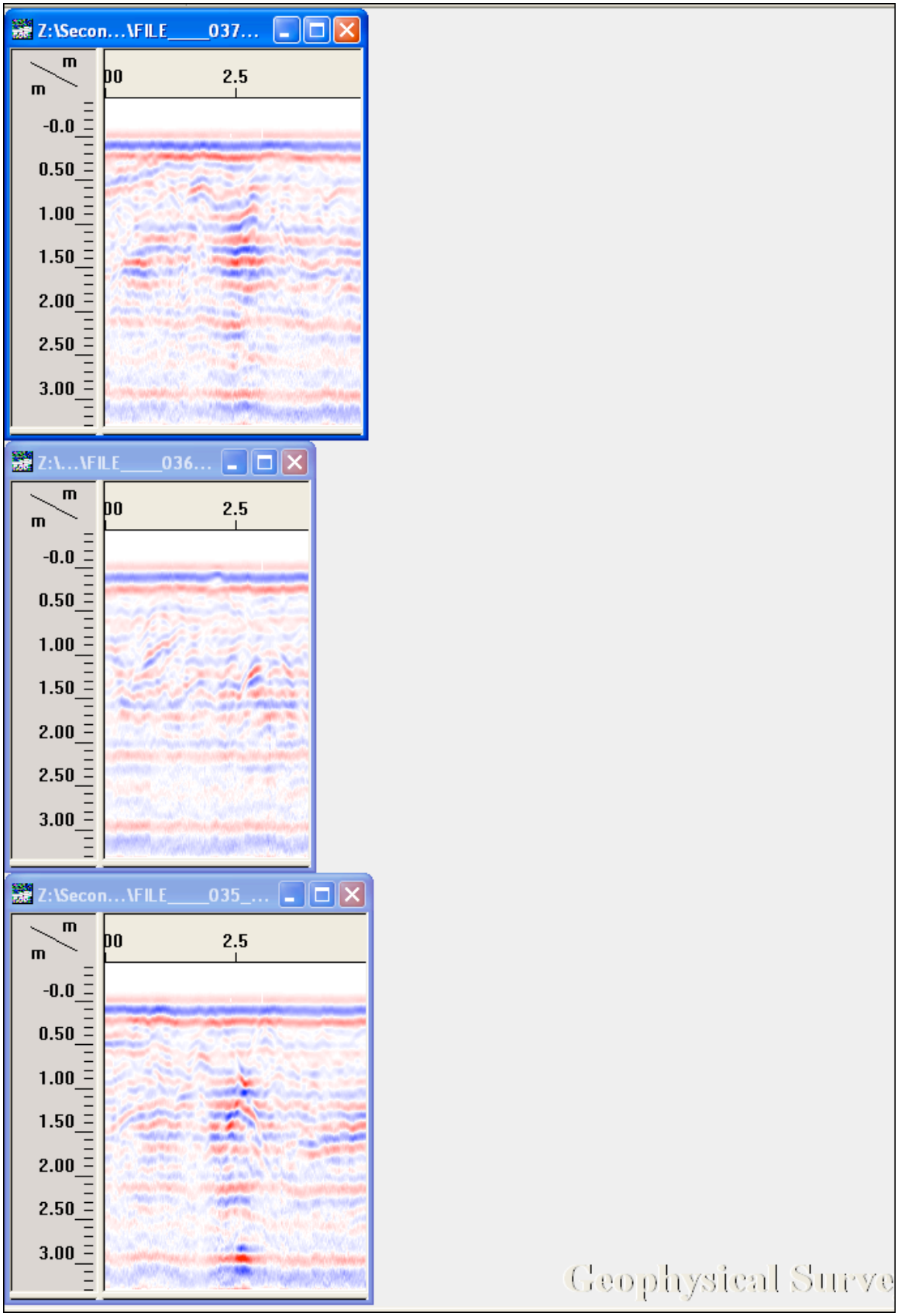
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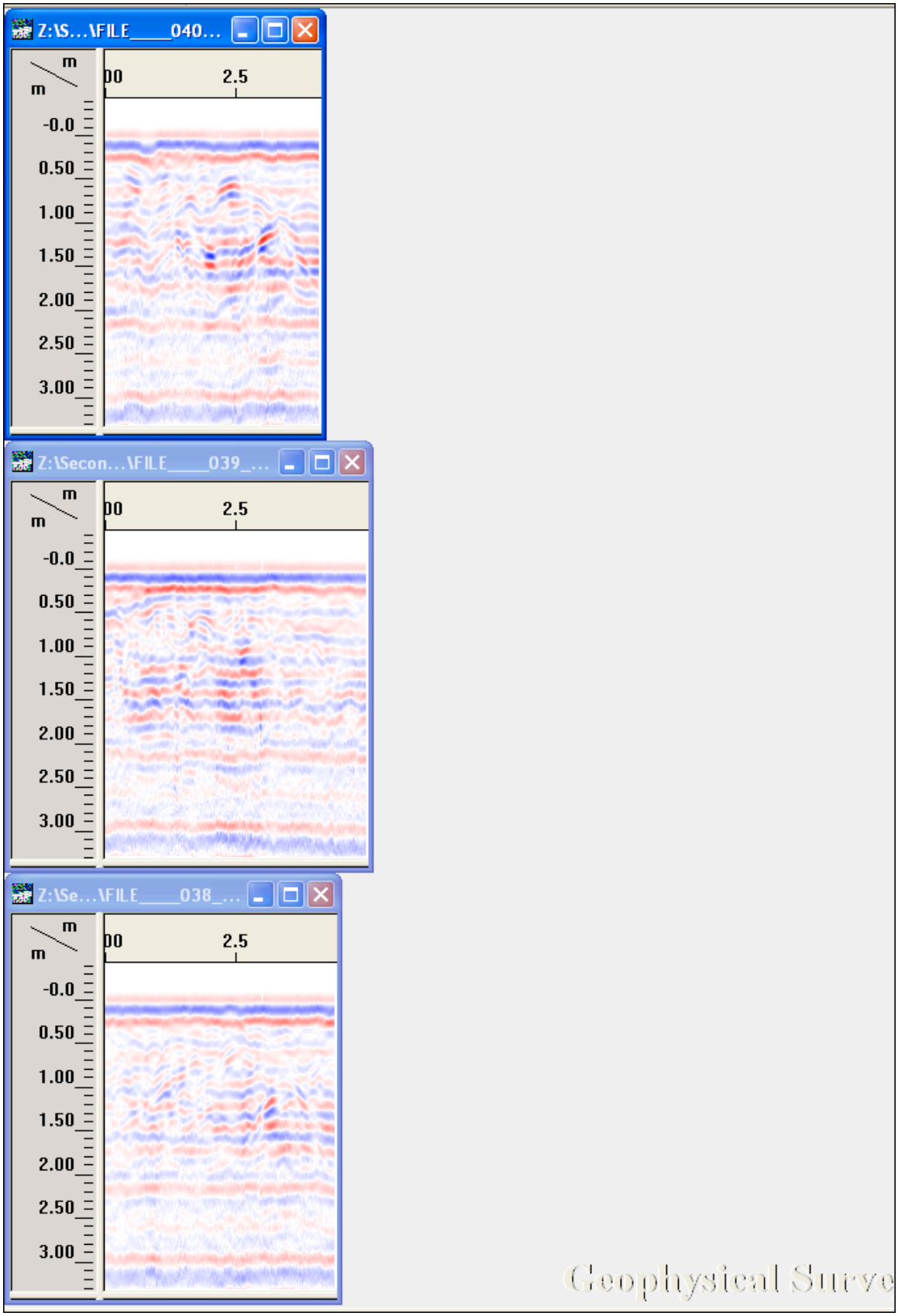
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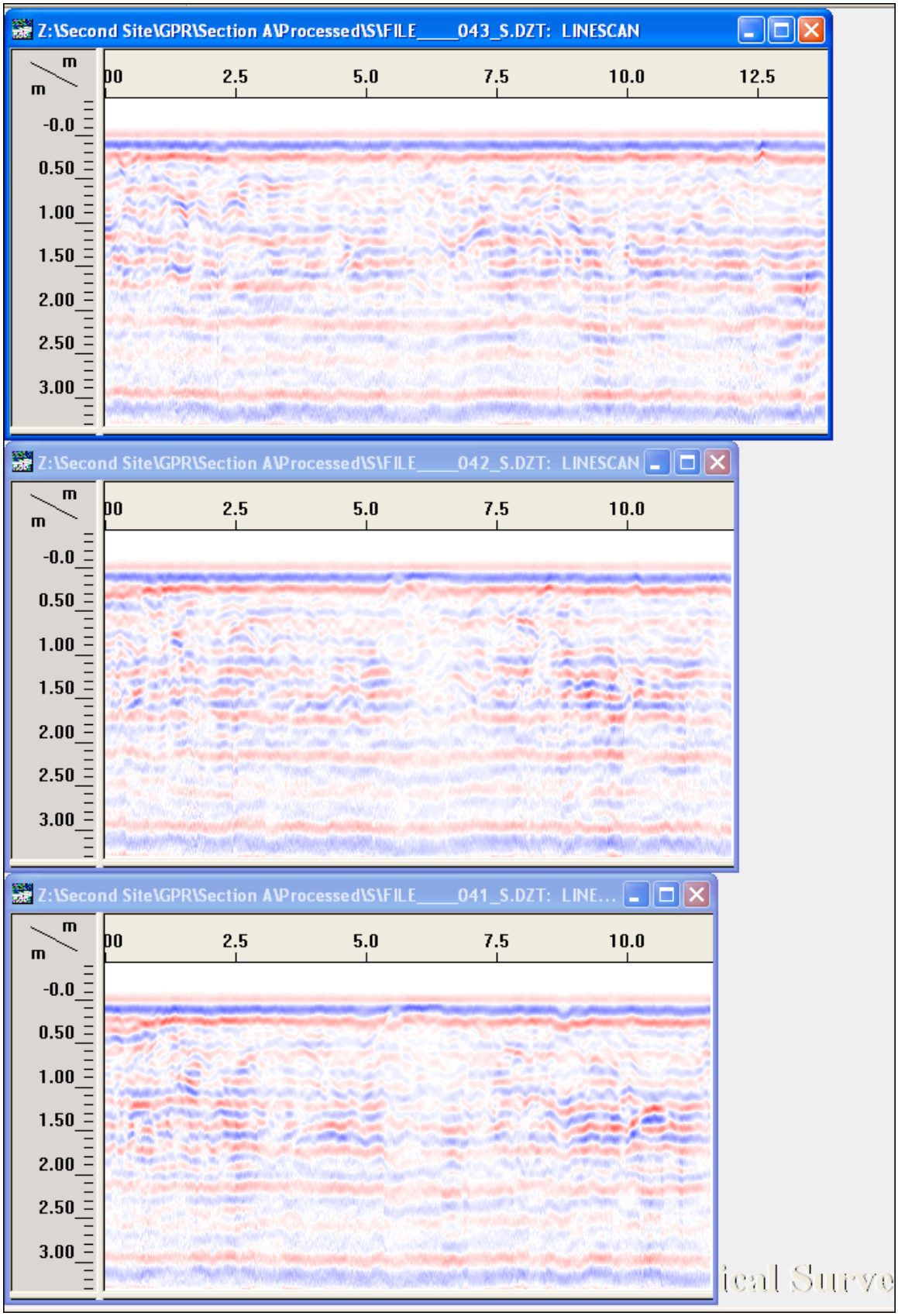
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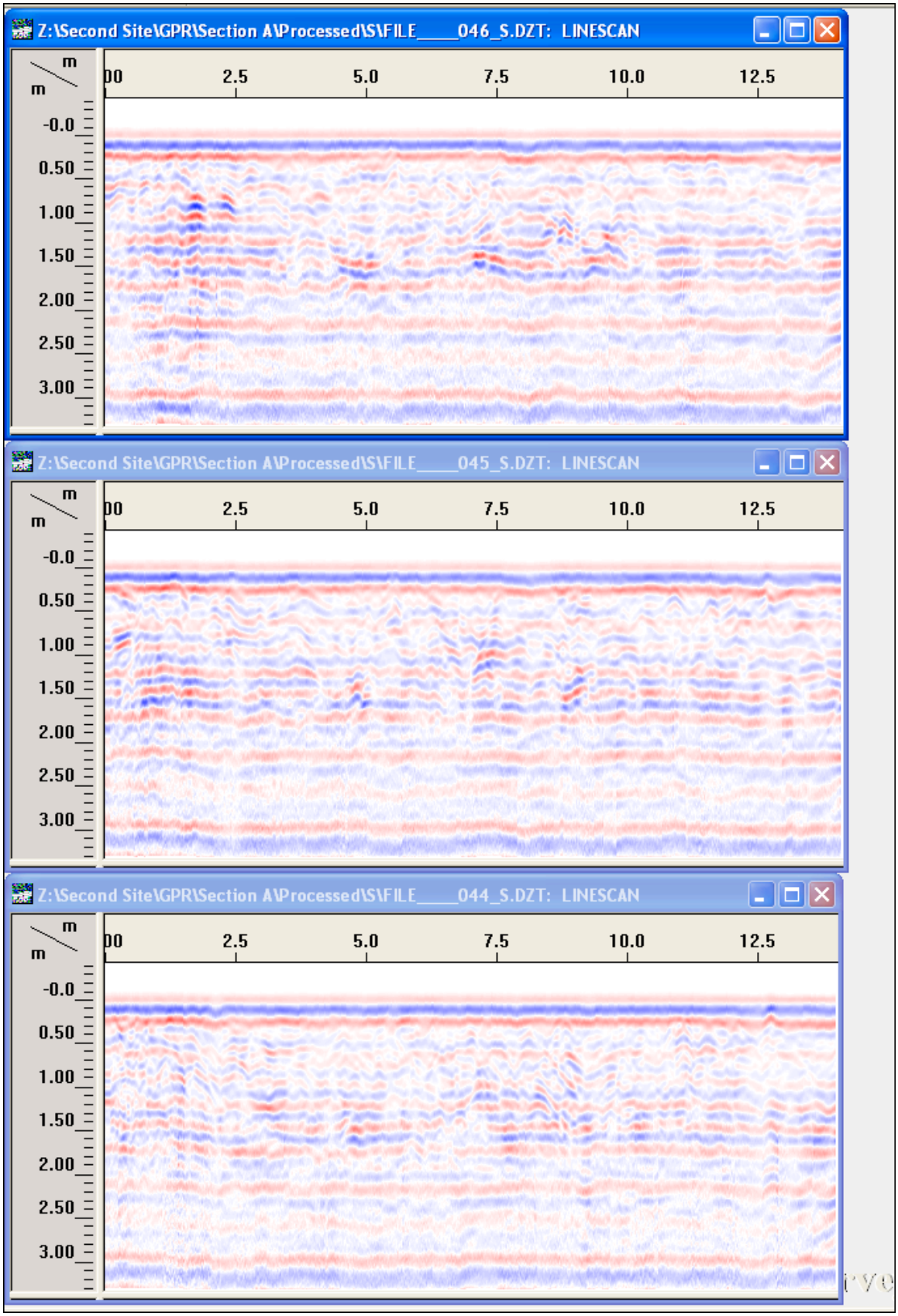
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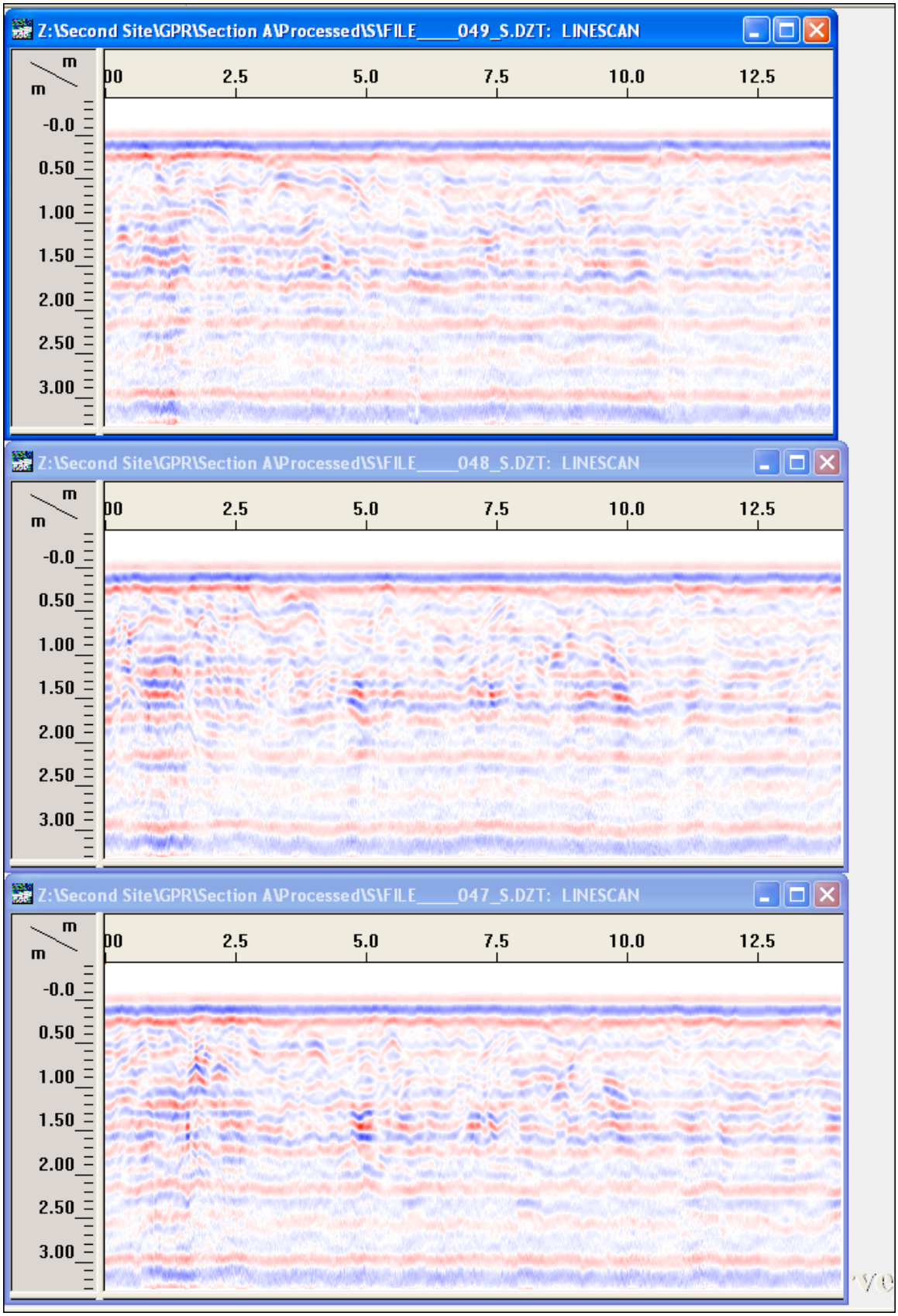
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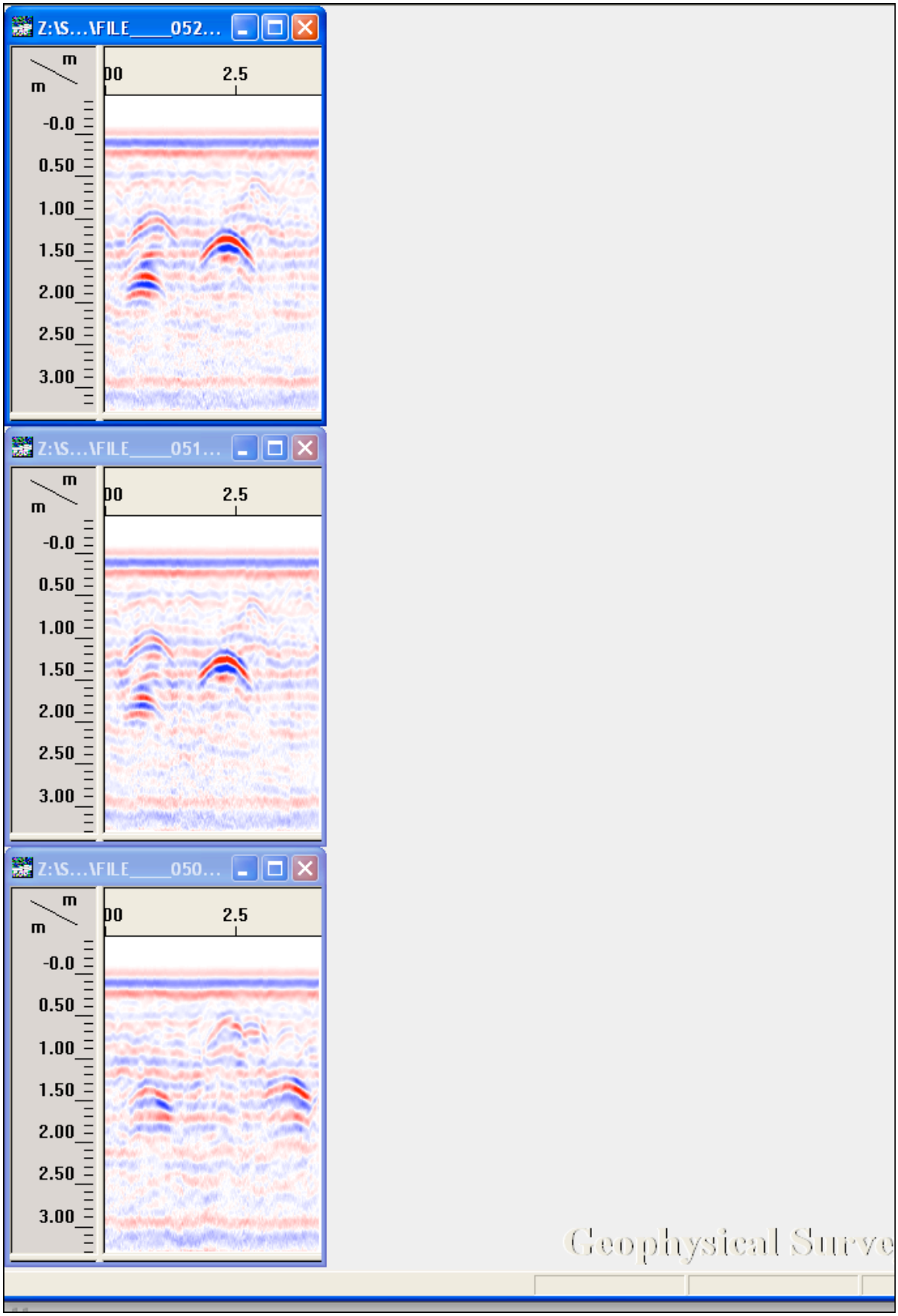
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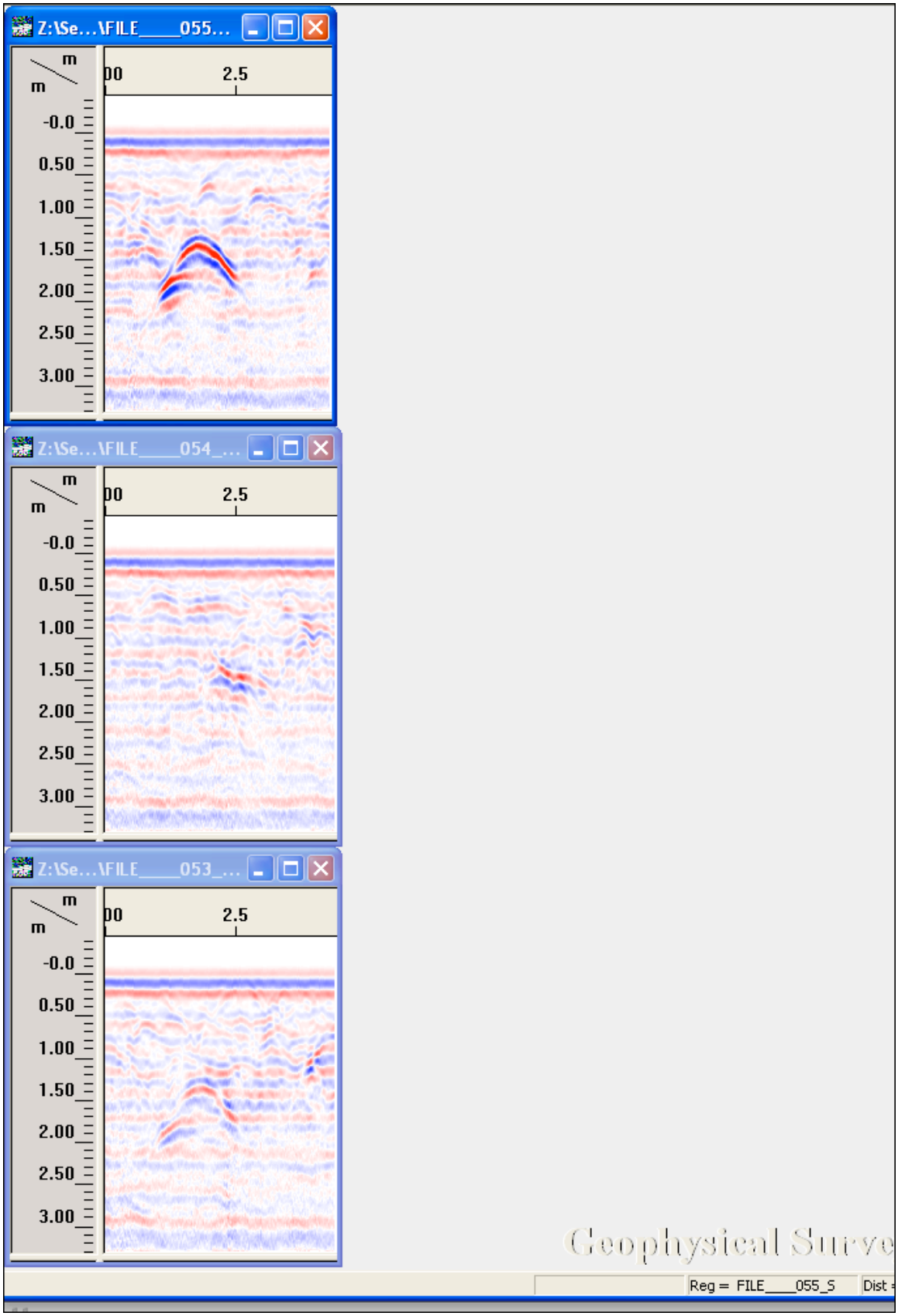
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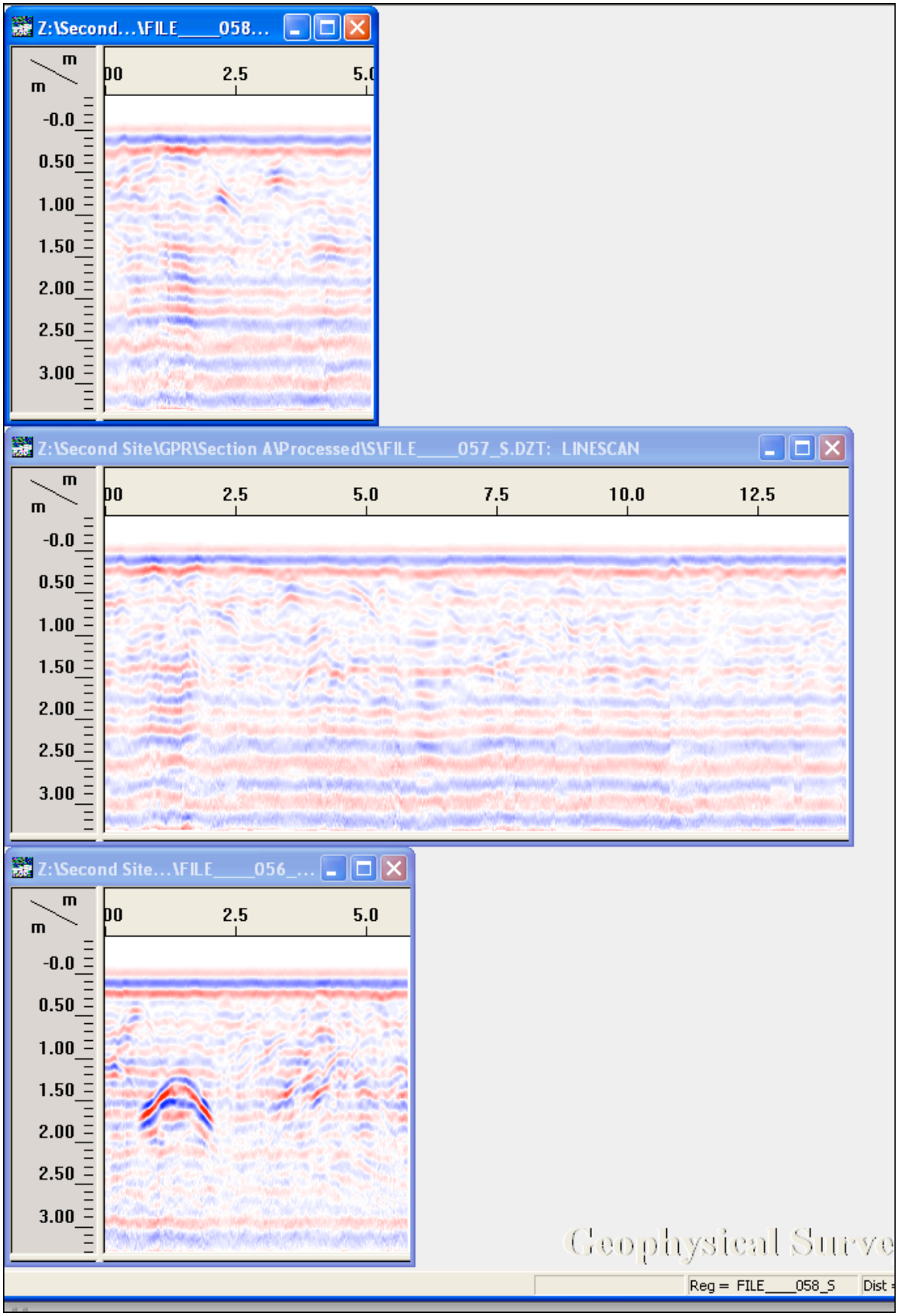
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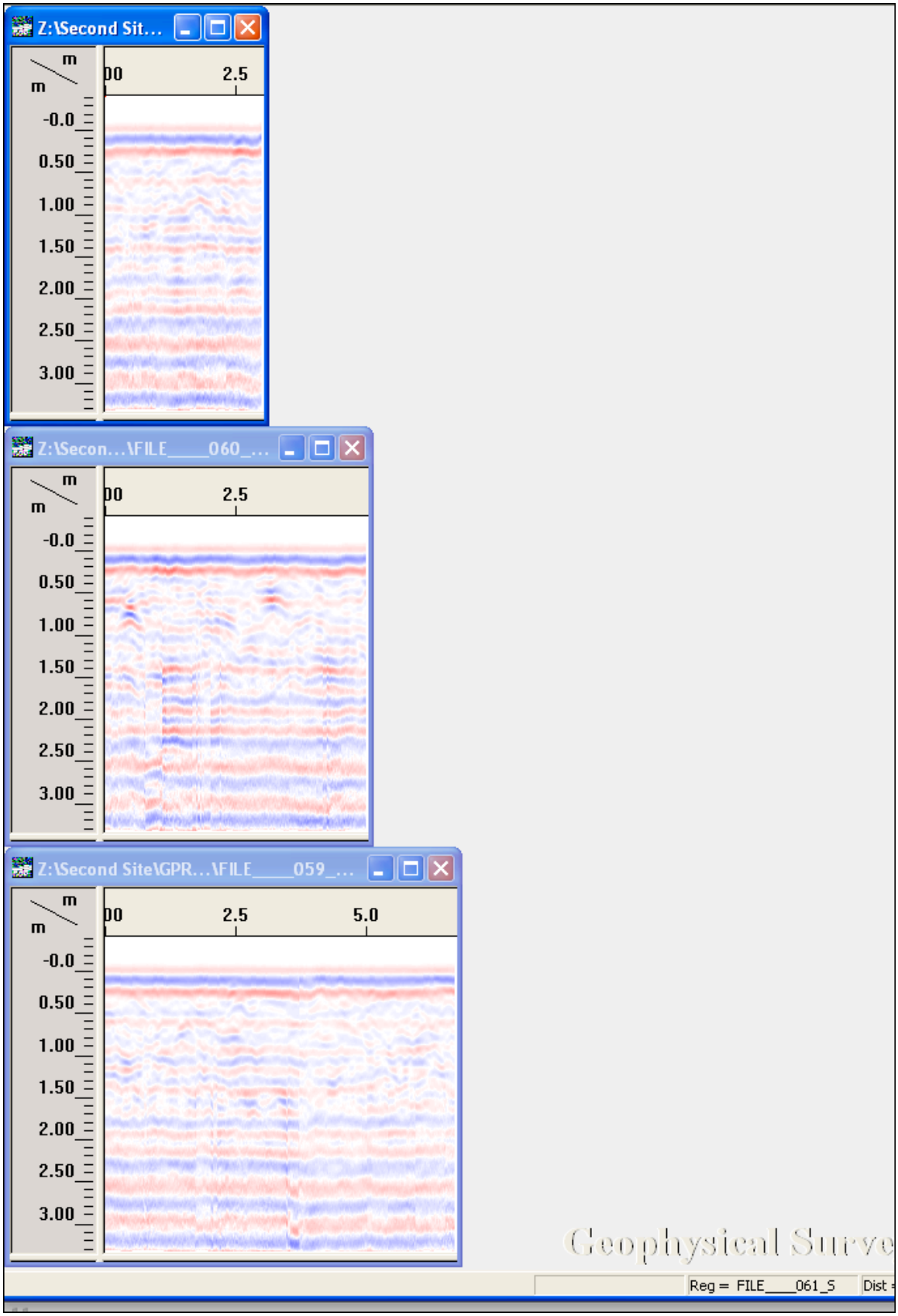
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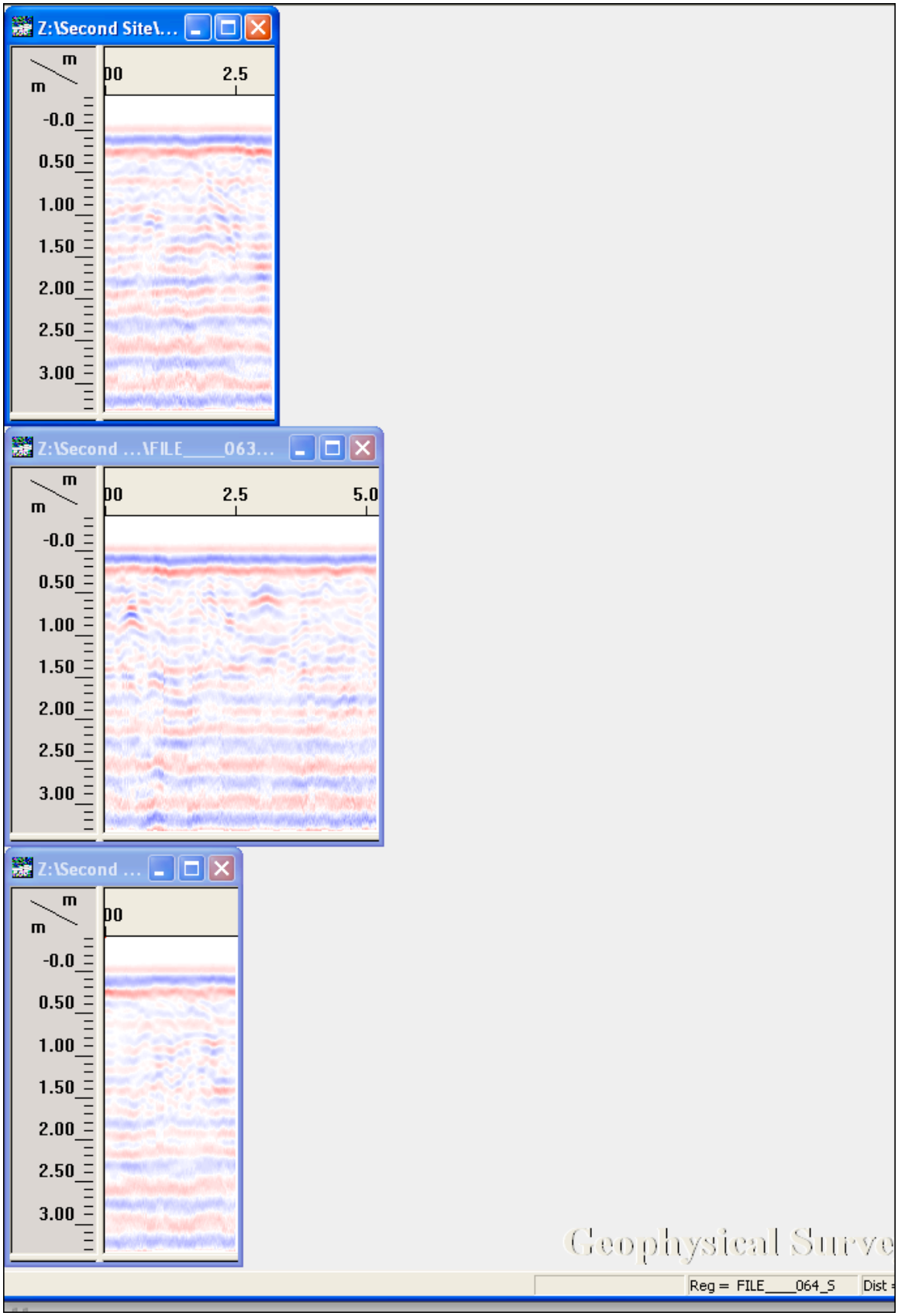
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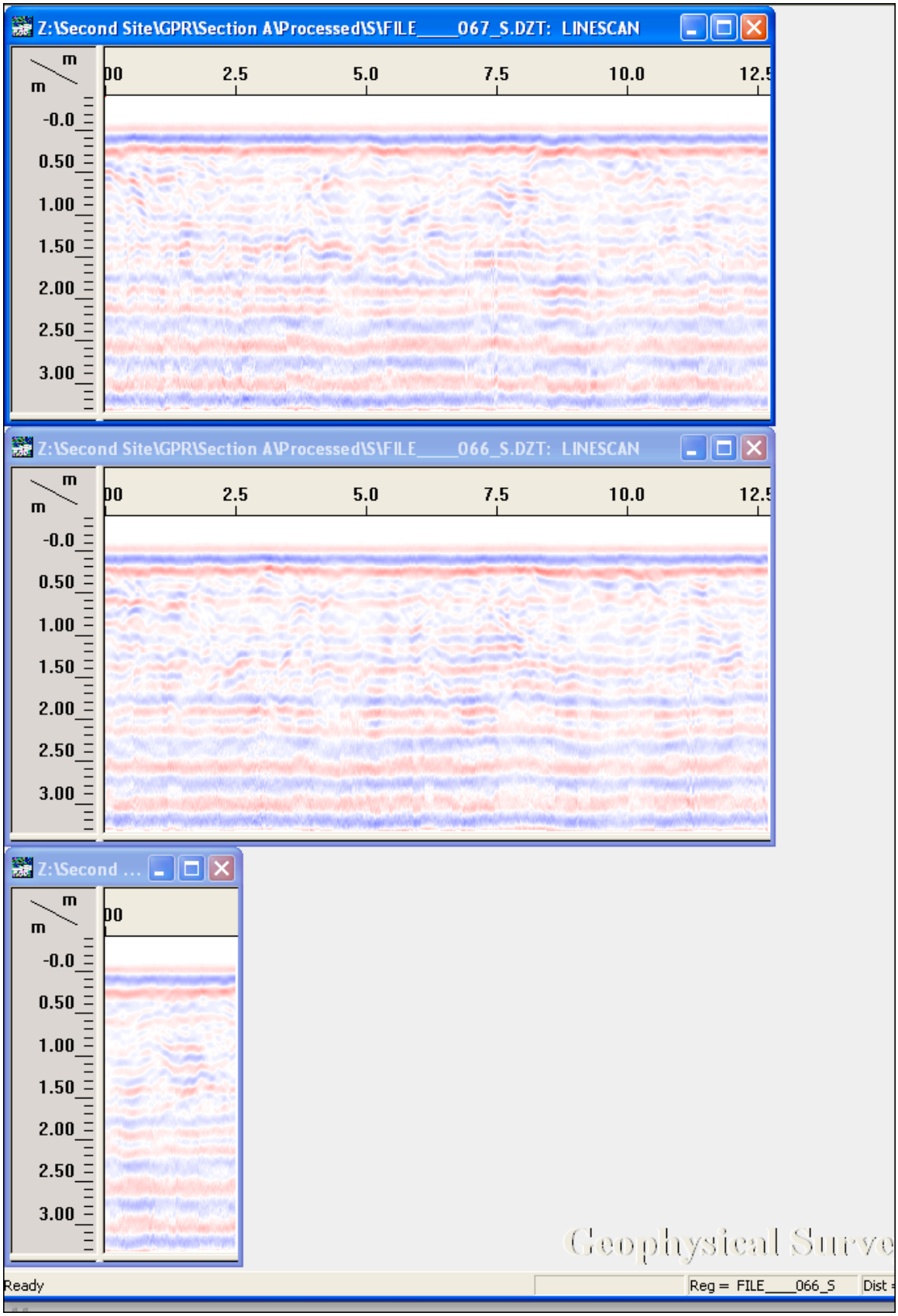
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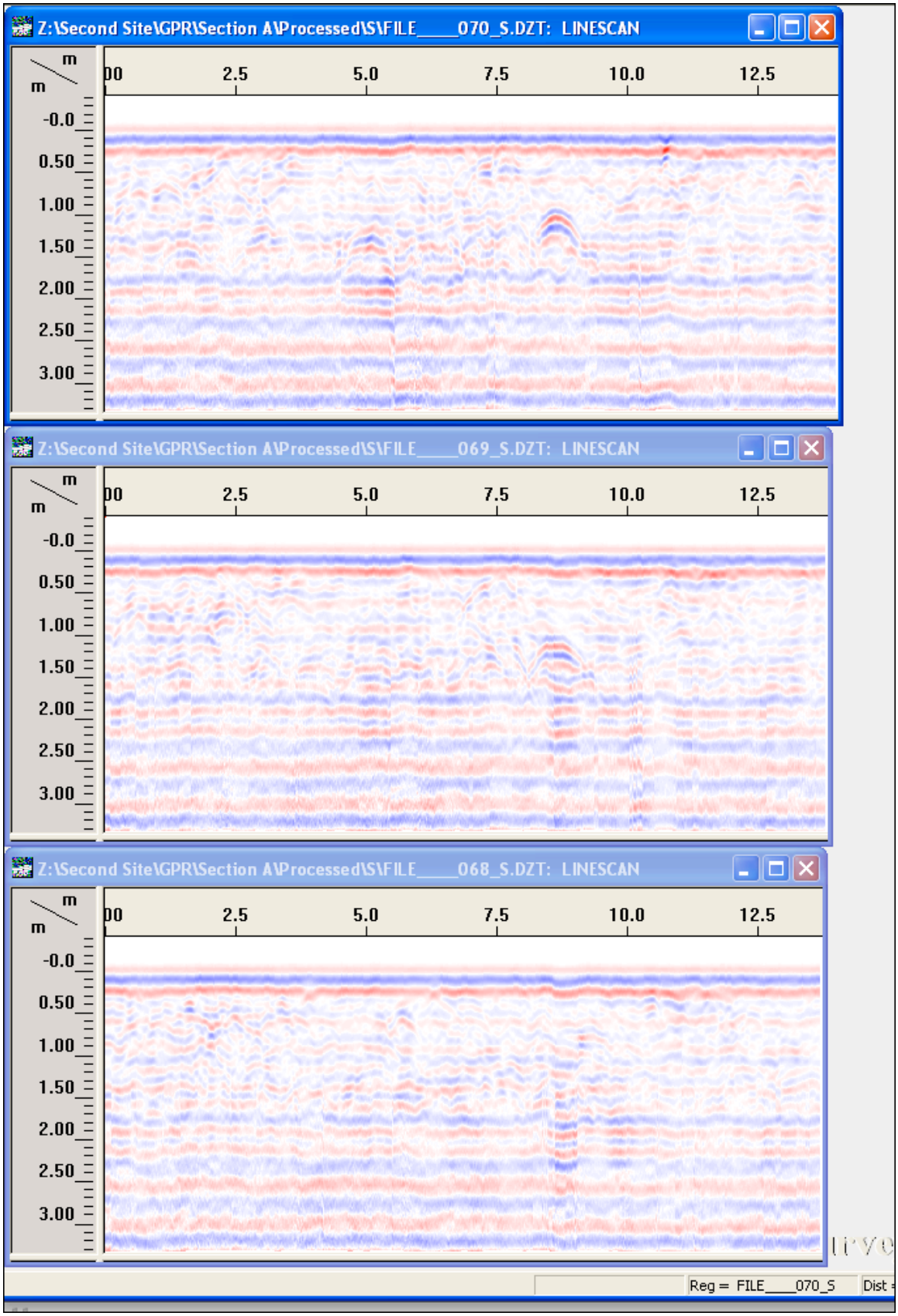
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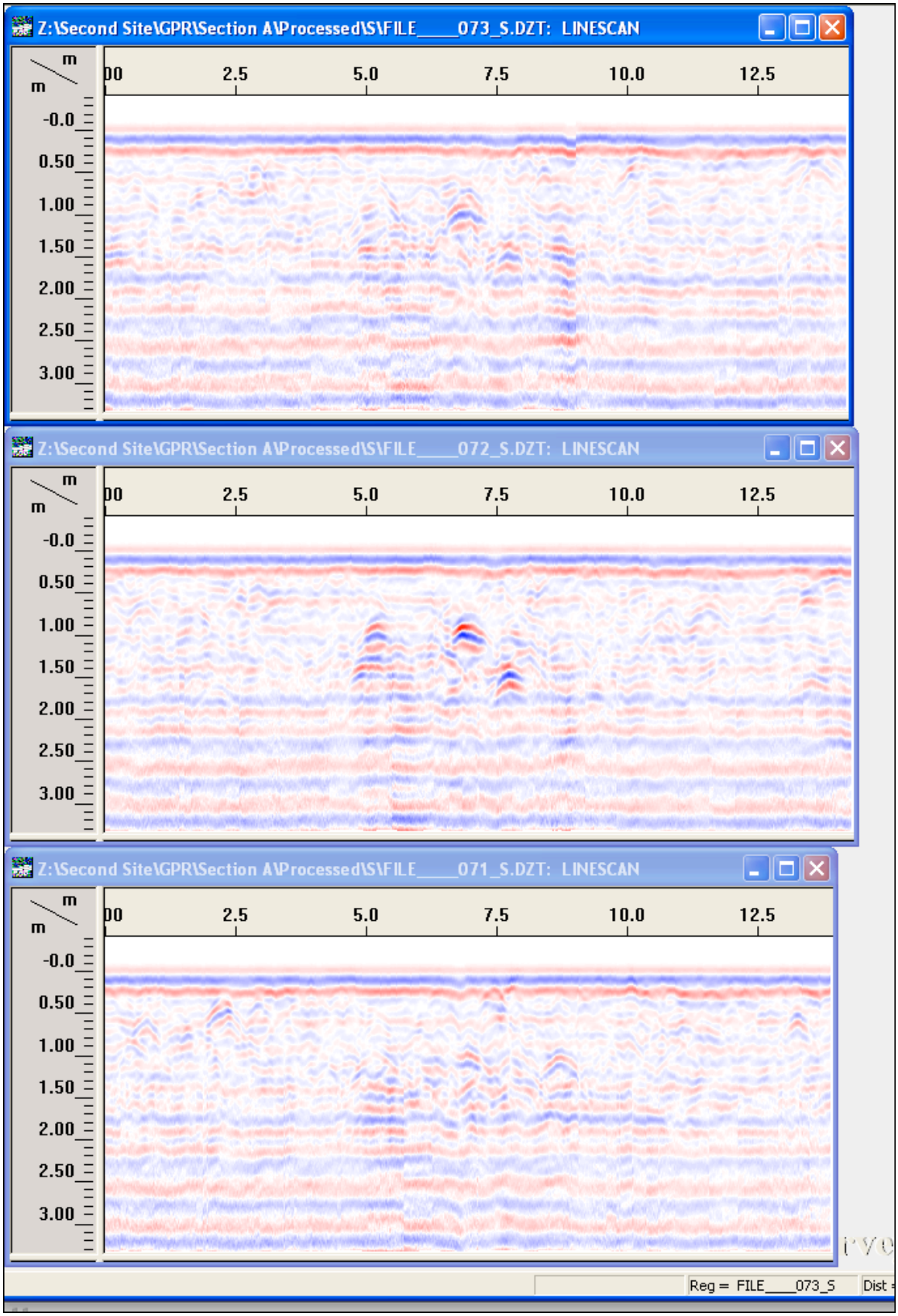
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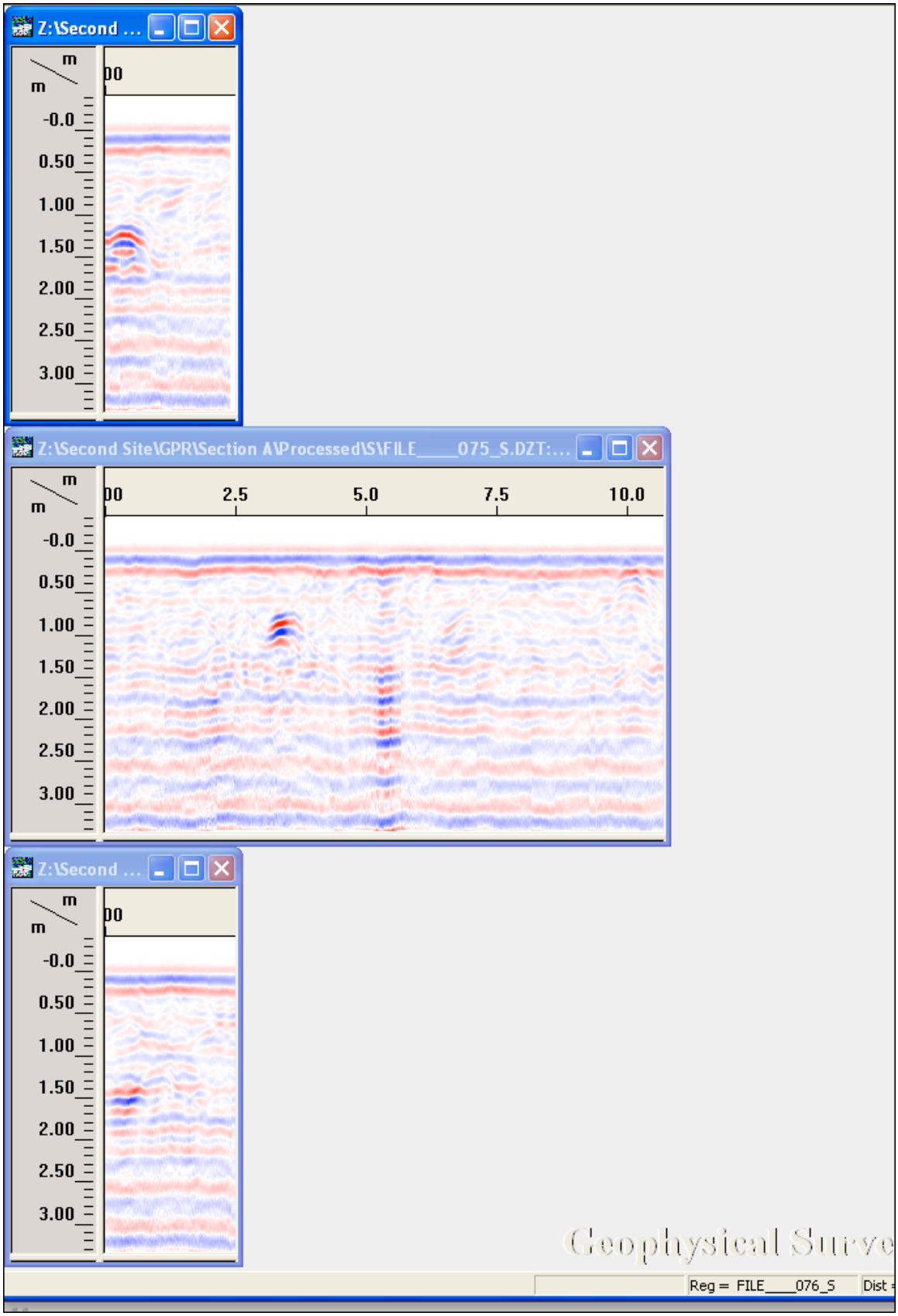
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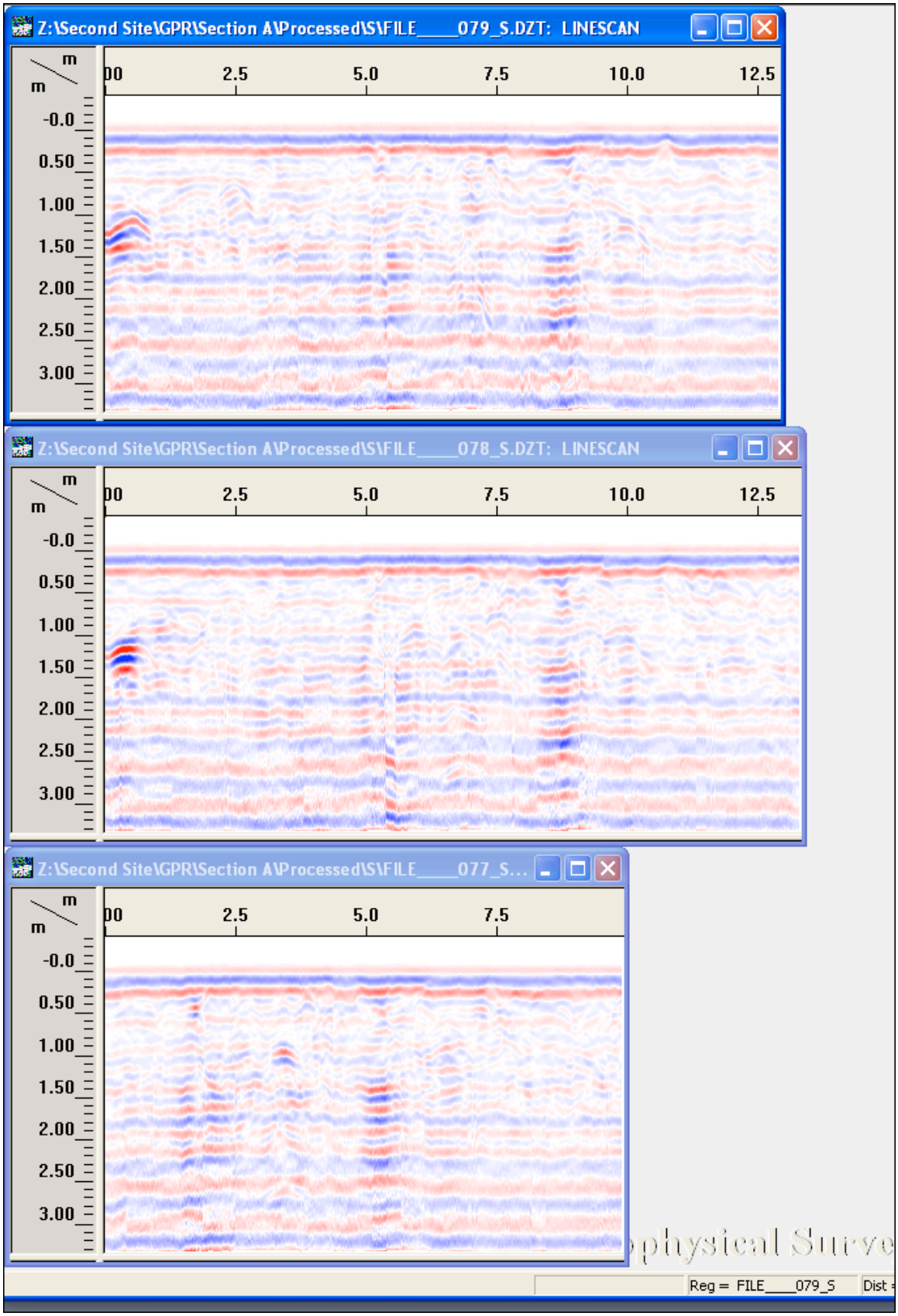
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Table 1-1

Profile #	GPR File #	Begin X' (m)	Begin Y' (m)	End X' (m)	End Y' (m)	Length (m)
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A002	21	14.8	15	14.8	0.7	14.3
A003	22	14.6	15	14.6	0.7	14.3
A004	23	14.4	15	14.4	0.7	14.3
A005	24	14.2	15	14.2	0.7	14.3
A006	25	14	15	14	0.7	14.3
A007	26	13.8	15	13.8	0.7	14.3
A008	27	13.6	15	13.6	0.7	14.3
A009	28	13.4	15	13.4	2	13
A010	29	13.2	15	13.2	2.7	12.3
A011	30	13	15	13	2.7	12.3
A012	31	12.8	15	12.8	2.9	12.1
A013	32	12.6	15	12.6	3.2	11.8
A014a	33	12.4	15	12.4	9.7	5.3
A014b	34	12.4	7.8	12.4	3.4	4.4
A015a	35	12.2	15	12.2	9.8	5.2
A015b	36	12.2	7.7	12.2	3.5	4.2
A016a	37	12	15	12	9.9	5.1
A016b	38	12	7.7	12	3.7	4
A017a	39	11.8	15	11.8	9.9	5.1
A017b	40	11.8	7.6	11.8	3.7	3.9
A018	41	11.6	15	11.6	3.4	11.6
A019	42	11.4	15	11.4	0.7	14.3
A020	43	11.2	15	11.2	0.7	14.3
A021	44	11	15	11	0.7	14.3
A022	45	10.8	15	10.8	0.7	14.3
A023	46	10.6	15	10.6	0.7	14.3
A024	47	10.4	15	10.4	0.7	14.3
A025	48	10.2	15	10.2	0.7	14.3
A026	49	10	15	10	0.7	14.3
A027	57	9.8	15	9.8	0.7	14.3
A028a	58	9.6	15	9.6	10	5
A028b	59	9.6	9.1	9.6	0.7	8.4
A029a	60	9.4	15	9.4	9.8	5.2
A029b	61	9.4	7.8	9.4	5	2.8
A029c	62	9.4	3.3	9.4	0.7	2.6
A030a	63	9.2	15	9.2	9.7	5.3
A030b	64	9.2	7.8	9.2	5.2	2.6
A030c	65	9.2	3.3	9.2	0.7	2.6
A031a	66	9	13.6	9	9.7	3.9
A032	67	8.8	13.6	8.8	0.7	12.9
A033	68	8.6	15	8.6	0.7	14.3
A034	69	8.4	15	8.4	0.7	14.3
A035	70	8.2	15	8.2	0.7	14.3

A036	71	8	15	8	0.7	14.3
A037	72	7.8	15	7.8	0.7	14.3
A038	73	7.6	15	7.6	0.7	14.3
A039a	74	7.4	15	7.4	12.7	2.3
A039b	75	7.4	11.5	7.4	0.7	10.8
A040a	76	7.2	15	7.2	12.6	2.4
A040b	77	7.2	11.6	7.2	0.7	10.9
A041	78	7	15	7	0.7	14.3
A042	79	6.8	15	6.8	0.7	14.3
A043a	80	6.6	15	6.6	7.6	7.4
A043b	81	6.6	6.3	6.6	0.7	5.6
A044a	82	6.4	15	6.4	7.9	7.1
A044b	83	6.4	6.4	6.4	5.7	0.7
A044c	84	6.4	4.3	6.4	0.7	3.6
A045a	85	6.2	15	6.2	8	7
A045b	86	6.2	7.3	6.2	0.7	6.6
A046a	87	6	15	6	14	1
A046b	88	6	12	6	7.9	4.1
A046c	89	6	6.2	6	0.7	5.5
A047	90	5.8	10	5.8	0.7	9.3
A048	91	5.4	15	5.4	0.7	14.3
A049	92	5.2	15	5.2	0.7	14.3
A050	93	5	15	5	0.7	14.3
A051	94	4.8	15	4.8	0.7	14.3
A052	95	4.6	15	4.6	0.7	14.3
A053	96	4.4	15	4.4	0.7	14.3
A054	97	4.2	15	4.2	0.7	14.3
A055	98	4	15	4	0.7	14.3
A056	99	3.8	15	3.8	0.7	14.3
A057	100	3.6	15	3.6	0.7	14.3
A058	101	3.4	15	3.4	0.7	14.3
A059	102	3.2	15	3.2	0.7	14.3
A060	103	3	15	3	0.7	14.3
A061a	104	2.8	15	2.8	10.4	4.6
A061b	105	2.8	8.7	2.8	0.7	8
A062a	106	2.6	13.4	2.6	10.4	3
A062b	107	2.6	8.7	2.6	0.7	8
A063	108	2.4	13.2	2.4	0.7	12.5
A064	109	2.2	13.4	2.2	0.7	12.7
A065	110	2	13.3	2	0.7	12.6
A067	111	1.8	15	1.8	0.7	14.3
A068	113	1.6	15	1.6	0.7	14.3
A069	114	1.4	15	1.4	0.7	14.3
A070	115	1.2	15	1.2	0.7	14.3

A071a	116	1	15	1	11	4
A071b	117	1	9.8	1	0.7	9.1
A072a	118	0.8	15	0.8	11.5	3.5
A072b	119	0.8	9.6	0.8	0.7	8.9
A073a	120	0.6	15	0.6	11.3	3.7
A073b	121	0.6	9.7	0.6	5.5	4.2
A073c	122	0.6	3.7	0.6	0.7	3
A074a	123	0.4	15	0.4	5.6	9.4
A074b	124	0.4	3.7	0.4	0.7	3
A075	125	0.2	15	0.2	0.7	14.3
A077	126	0	15	0	0.7	14.3