

U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

LITHOLOGIC DESCRIPTION OF SEDIMENT CORES FROM
GRASS LAKE, SISKIYOU COUNTY, CALIFORNIA

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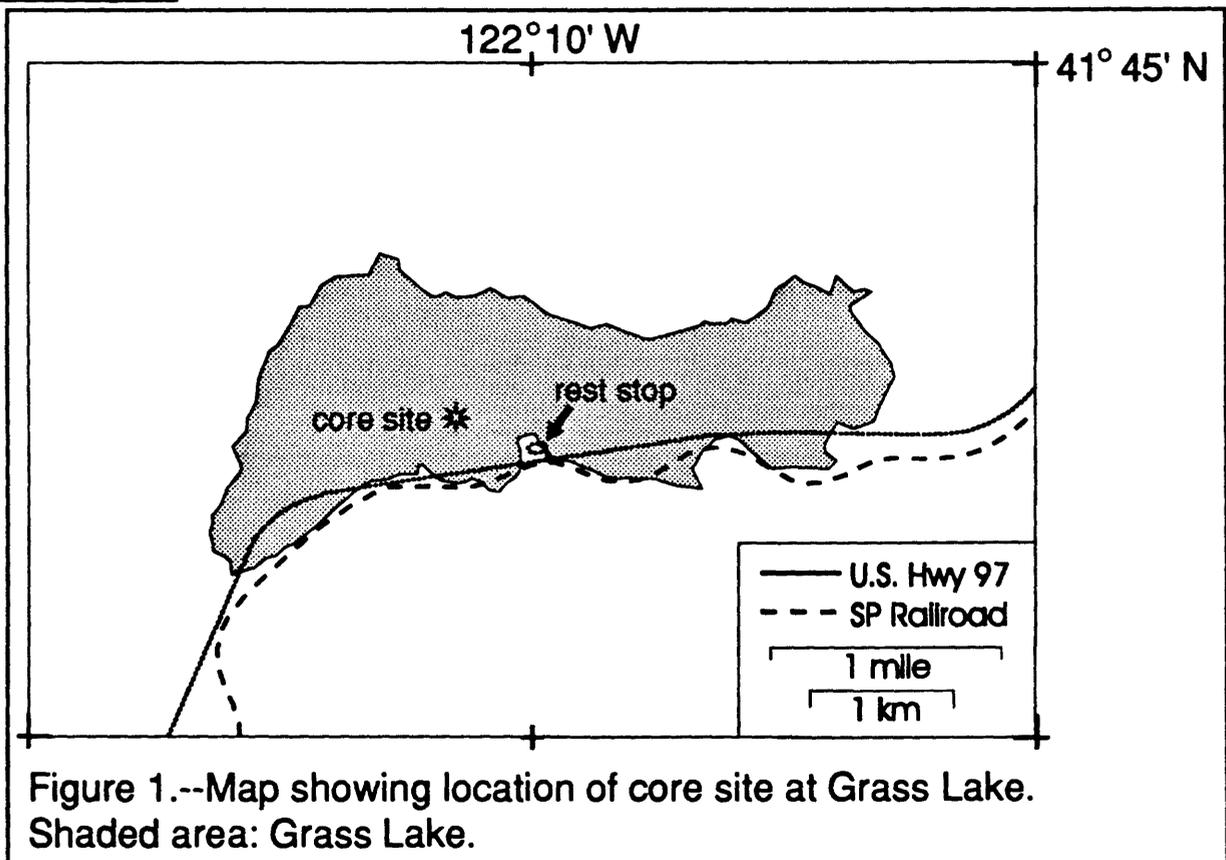
Introduction

As part of a series of investigations designed to study the Quaternary climatic histories of the western U.S. and the adjacent northeastern Pacific Ocean, two sediment cores were collected from Grass Lake, Siskiyou County, California, in the fall of 1991. This report presents basic data concerning the Grass Lake site, as well as lithologic descriptions of the recovered sediments. The drilling methods and core sampling and curation techniques used are described by Adam (1993).

Acknowledgement

Coring at Grass Lake was made possible by the gracious cooperation of the Fruit Growers Supply Co., owners of Grass Lake, and the grazing permit holder, the Table Rock Ranch.

Site description



Grass Lake (Figure 1) lies just east of the crest of the southern Cascade Range at an elevation of about 5050 feet (1540 m), about half way between Mt. Shasta and the Klamath River gorge. The present Grass Lake is actually a large wet meadow which occupies a closed depression that was created when a lava flow from Little Deer Mountain blocked a valley that drained to the east. The basin is underlain by porous and permeable volcanic rocks mapped by Williams (1949) as olivine basalts and basaltic andesites of Pliocene and Quaternary age, and by Wood (1960) as 'Older and younger volcanic rocks of the "High Cascades"'.

According to visitor information displayed at a rest stop along U.S. Highway 97 at the south side of Grass Lake, the basin actually held a lake in early historic time, and a hotel was

located at the present site of the rest stop. Early in the 20th century, an ill-fated development effort inadvertently penetrated the sediment seal atop the underlying permeable rocks, and the lake drained through what is known locally as "The Glory Hole", which is still clearly visible at the western edge of the rest stop.

Core descriptions

Two cores, designated here as Core 1 and Core 2, were taken at Grass Lake between October 8th and 10th, 1991.

Core 1 reached a maximum depth of only 1.35 m because of an equipment malfunction. Core 2 was taken a short distance away, and penetrated to a depth of 30.64 m. The upper 4 m was cored using Shelby tubes, and problems were encountered with sediment collapsing into the core hole between drives. The part of the section below 4 m was sampled using conventional rotary drilling, mud, and a 3-inch core barrel.

Core recovery

The depth interval drilled for each drive and the percent recovery are shown in Figure 2 and in Tables 1 (Core 1) and 2 (Core 2). For each core, the Figure 2 column labeled "Drives" shows an unlabeled, shaded box for each drive recovered. The upper boundary represents the depth at which drilling began for that drive as reported by the driller plus a possible adjustment to account for >100% recovery. These boxes are offset in an alternating pattern to facilitate comparison of the bottom of one drive with the top of the next drive. Immediately to the right of the "Drives" column, the "Slugs" column displays similar but labeled boxes that identify the drive, the slugs (A, and sometimes B and C) into which the drive was divided for storage, and the thickness of sediment actually recovered. In addition, some drives are plotted using a vertical offset that compensates for apparent overlap between drives (see example below). The data used are shown in Tables 1 and 2.

As an example, consider Core 2, Drives 4 and 5. Drive 4 extended from a starting depth of 9.45 m to a bottom depth of 12.5 m, recovering 1.76 m of sediment from an interval 3.05 m thick, for a recovery of 57.7% (Table 2). Drive 5 extended from 12.50 to 14.02 m and recovered 2.35 m of sediment from a 1.52-m-thick interval, for a recovery of 154.2%. The "extra" recovery for drive 5 is assumed to represent material left in the hole when drive 4 was recovered. Similar overlaps are found between drives 15 and 16, 20 and 21, and 21 and 22. However, the total amount of sediment recovered from the hole, as shown in the "Slugs" column, can be accommodated within the total depth drilled if a few adjustments are made to the top depths of selected drives. The adjustment for drive 5 is -1.29 m, as shown in the column labeled "Offset" (Table 2). The offset is added to the driller's depth for the top of the drive to produce a calculated depth for the top of the drive. The depths shown on the lithologic logs in Appendices B and C are based on the calculated depths for the tops of the drives.

In Core 2, particular problems were encountered with sediment collapsing into the hole between drives for the Shelby tube part of the section (see above). Although we have used the drive top offset corrections to accommodate all of the recovered core within the total depth sampled, this has introduced some distortions within the top 4 meters of section. All of the deposits reported here are in proper stratigraphic order (except for any caved debris), but the reported depths should not be used to calculate sedimentation rates without referring to the original core log sheets.

Dating

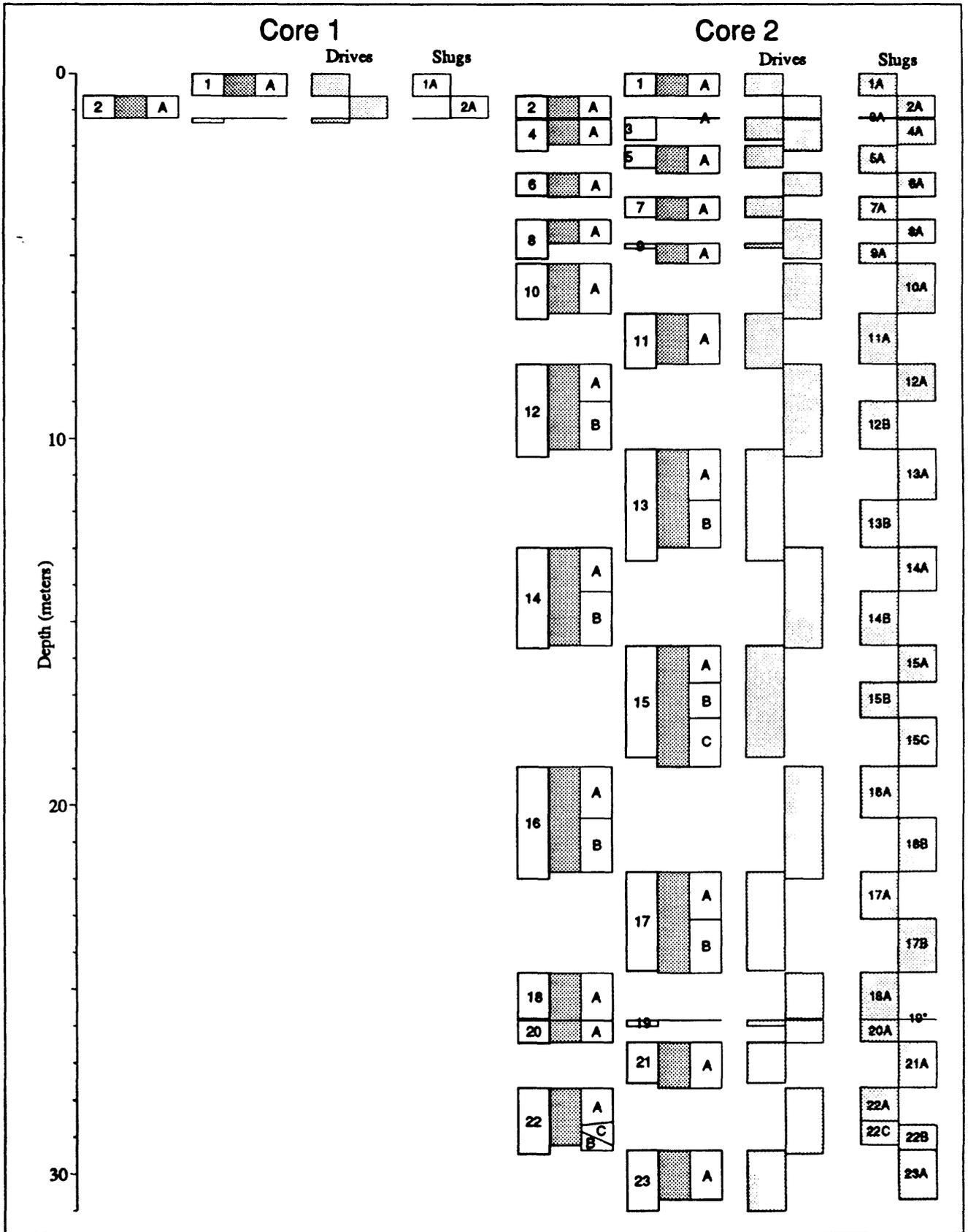


Figure 2.--Graphic depiction of core recovery for Grass Lake Cores 1 and 2. See text for discussion.

Age control for the cores is derived from tephra layers identified in Core 2 (Table 3) and from four radiocarbon age estimates (Table 4). The section is of middle and upper Pleistocene and Holocene age.

Lithology

A very generalized lithology of the section is shown in Figure 3; detailed lithologic logs for cores 1 and 2 are shown in Appendices B and C, using the patterns shown in Appendix A. Depths are shown in meters from the ground surface. Each stratigraphic unit is described to the right of the stratigraphic column. Most descriptions were taken from the fresh cores in the field, but some further descriptions were done in the laboratory. Color codes are taken from the Rock Color Chart distributed by the Geological Society of America (Rock Color Chart Committee, 1948).

The record indicates that the Grass Lake basin has existed for at least the past one hundred thousand years, with alternating intervals of highly organic vs. inorganic sedimentation. The earliest part of the core includes intervals of debris flow deposits. These are overlain by a series of sandy, silty, or fine-grained basin deposits with variable organic content. The two identified tephra provide correlations to pollen records at Clear Lake (Adam, 1988) and Tulelake (Adam and others, 1989; Sarna and others, 1991), California, and to the deep-sea record of DSDP Core 173.

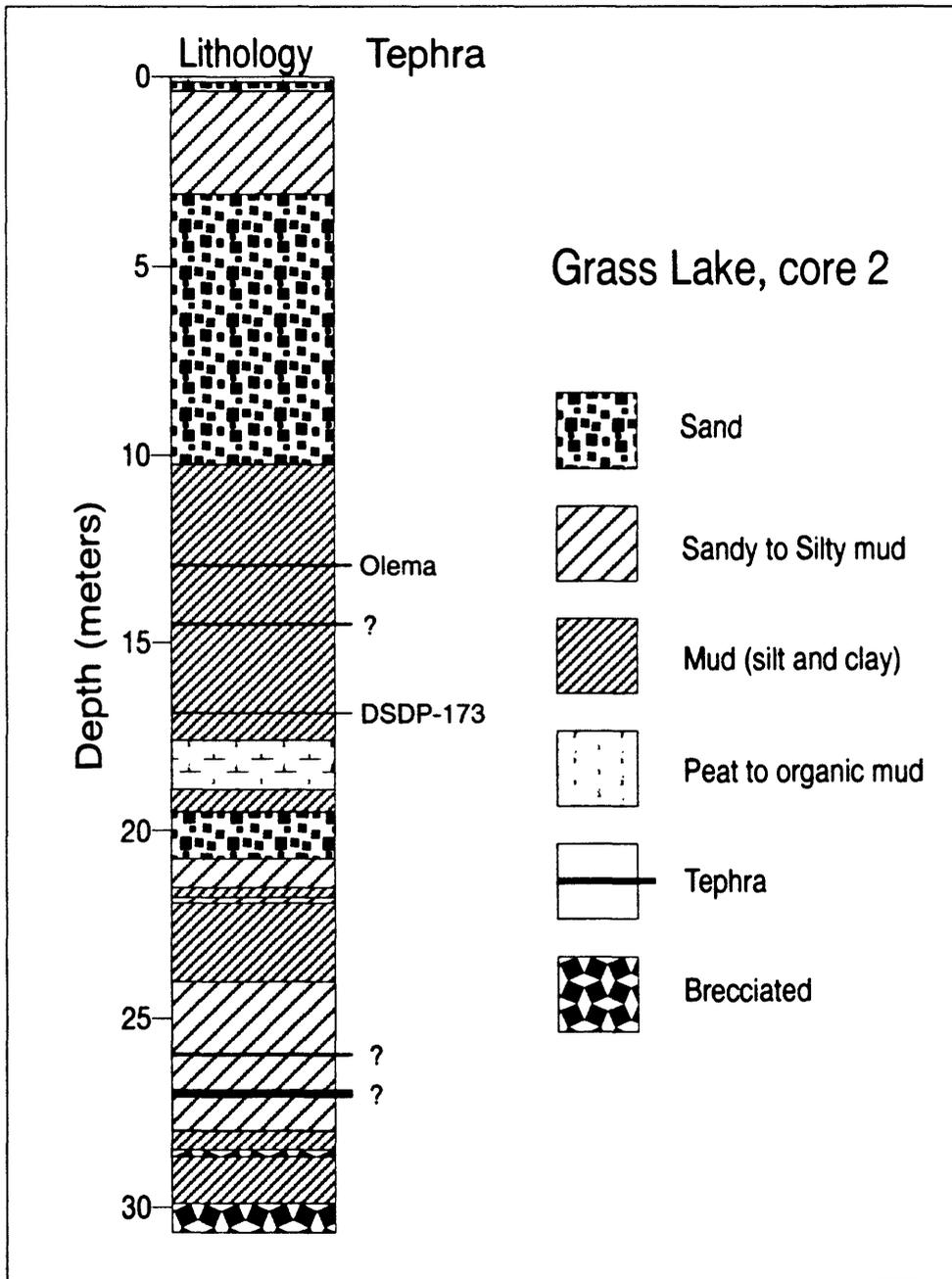


Figure 3.—Summary lithology of the Grass Lake section.

Table 1.--Drive data for Grass Lake Core 1

Drive number	Driller's Depth (m)		Recovery		Offset	Calculated depth for top of drive (m)
	Top	Bottom	meters	Percent		
1	0.00	0.61	0.61	100.0	0.00	0.00
2	0.61	1.22	0.61	100.0	0.00	0.61
3	1.22	1.98	0.15	20.0	0.00	1.22
4	1.35	1.98	0.00	0.0	-0.63	1.35

Table 2.--Drive data for Grass Lake Core 2

Drive Number	Driller's depths		Recovery		Offset	Calculated depth for top of drive (m)
	Top	Bottom	meters	percent		
1	0.00	0.61	0.62	101.7	0.00	0.00
2	0.61	1.22	0.60	98.4	0.01	0.62
3	1.22	1.83	0.0	0.0	0.00	1.22
4	1.27	2.13	0.69	80.2	0.00	1.22
5	2.13	2.74	0.76	124.5	-0.15	1.91
6	2.74	3.35	0.64	104.9	-0.01	2.67
7	3.35	3.91	0.64	114.3	0.02	3.31
8	2.90	3.96	0.64	60.3	1.11	3.95
9	3.96	4.09	0.55	423.1	0.69	4.59
10	3.96	5.49	1.37	89.5	1.24	5.14
11	5.49	7.01	1.41	92.8	1.08	6.51
12	7.01	9.53	2.31	91.7	0.97	7.92
13	9.53	12.58	2.69	88.2	0.76	10.23
14	12.58	15.32	2.67	97.4	0.40	12.92
15	15.32	18.37	3.30	108.2	0.13	15.59
16	18.37	21.42	2.86	93.8	0.58	18.89
17	21.42	24.11	2.75	102.2	0.39	21.75
18	24.11	25.36	1.29	103.2	0.45	24.50
19	25.36	25.51	0.00	0.0	0.49	25.79
20	25.51	26.12	0.59	96.7	0.34	25.79
21	26.12	27.21	1.23	112.8	0.32	26.38
22	27.21	28.99	1.55	87.1	0.46	27.61
23	28.99	30.64	1.34	81.2	0.36	29.29

Table 3.--Identified tephra from Grass Lake Core 2

<u>Tephra layer</u>	<u>Depth (m)</u>	<u>Age (kyr)</u>
Olema ash bed	14.10-14.14	55-65 ka
Ash bed matching DSDP 173-1-3,4	16.60-16.62	~120 ka (?)

Table 4.--Radiocarbon dates from Grass Lake core 2

<u>Depth (m)</u>	<u>Material</u>	<u>Radiocarbon age</u>	<u>Lab number</u>
1.36 - 1.41	bulk sediment	6,640 ± 70	WW-353; CAMS-14786
2.93 - 2.96	bulk sediment	3,640 ± 70	WW-354; CAMS-14787
4.95 - 4.98	bulk sediment	12,810 ± 810	WW-272; CAMS-12667
5.71 - 5.74	bulk sediment	16,160 ± 170	WW-271; CAMS-12666
7.01 - 7.03	bulk sediment	22,990 ± 410	WW-355; CAMS-14788
8.22 - 8.25	bulk sediment	not enough carbon	---
9.75 - 9.77	bulk sediment	23,810 ± 460	WW-357; CAMS-14789
11.78 - 11.80	bulk sediment	>34,000	WW-358; CAMS-14790

References Cited

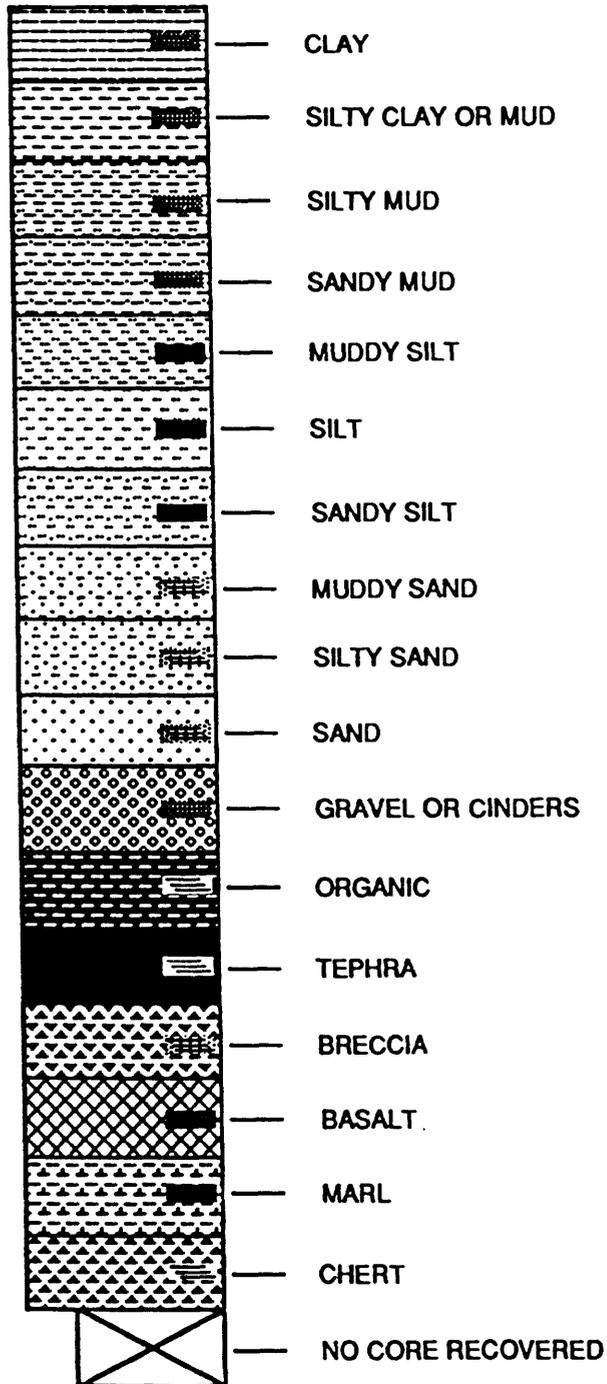
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Appendix A

Legend showing patterns used for Lithologic Logs

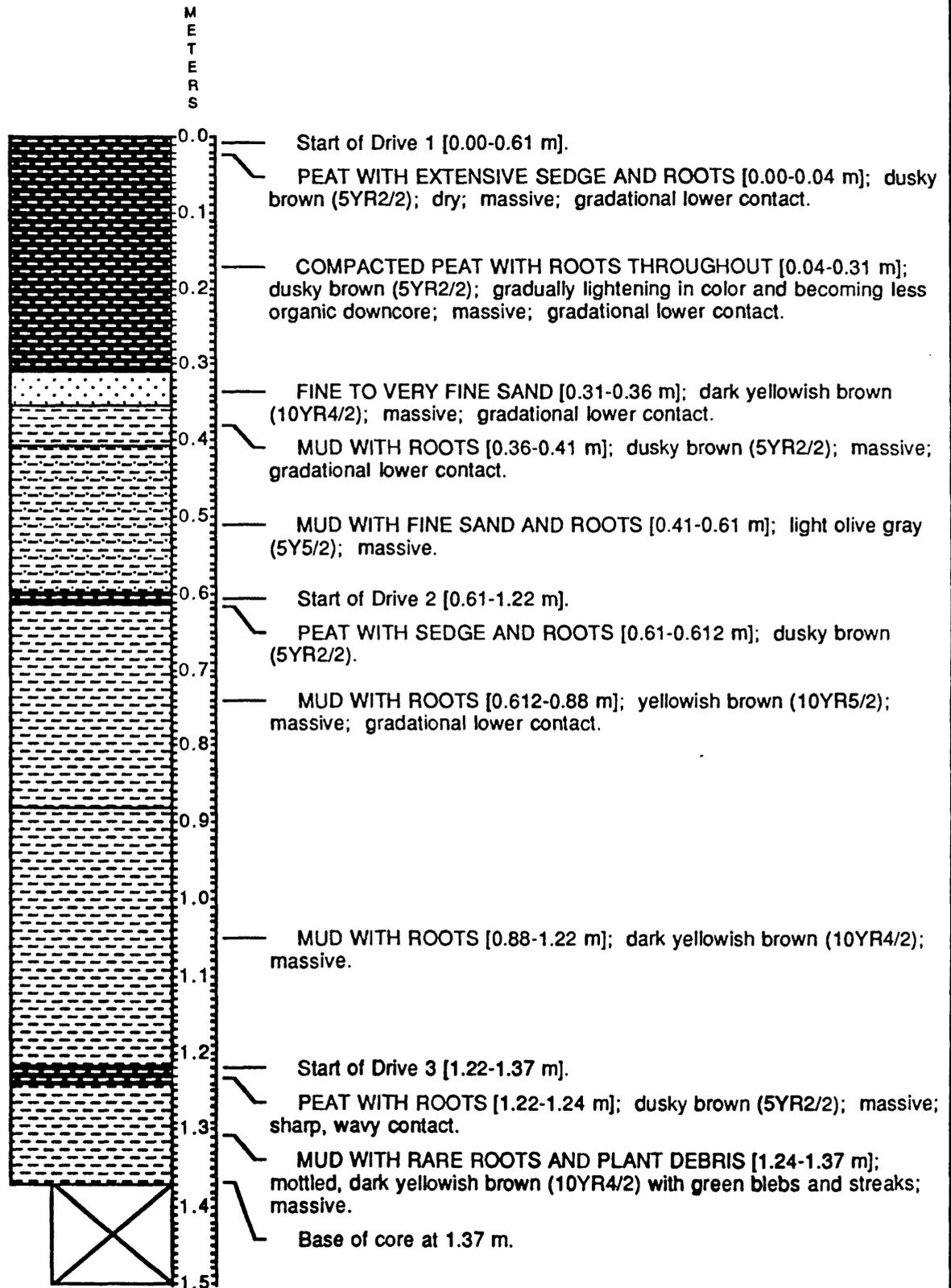
Small box inset within each pattern is used to indicate laminations within the unit (see written descriptions for more detail).

KEY TO LITHOLOGIES AND LAMINATION SYMBOL



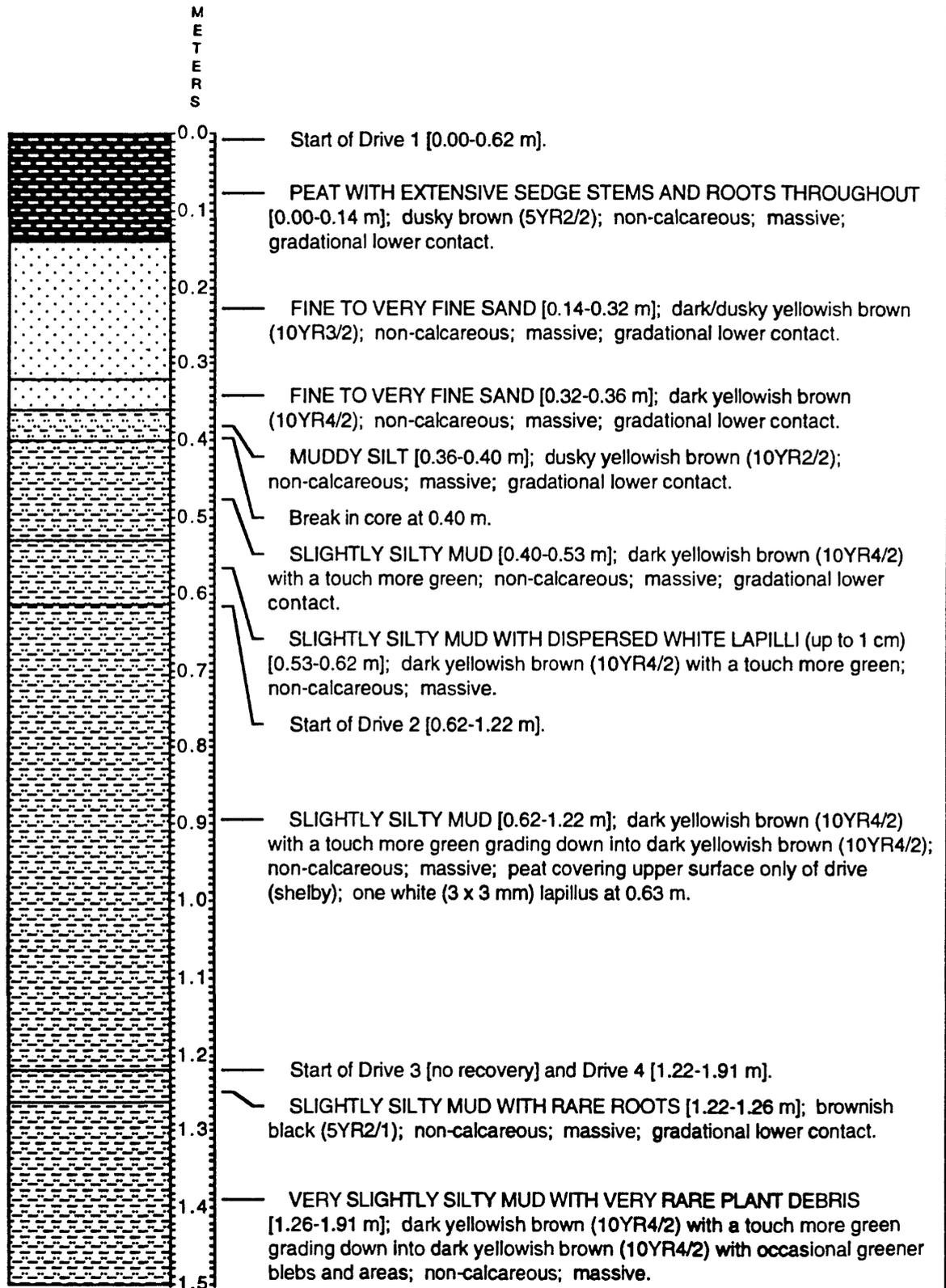
Appendix B
Core 1 Lithologic Log

Grass Lake, Core 1 Siskiyou County, California

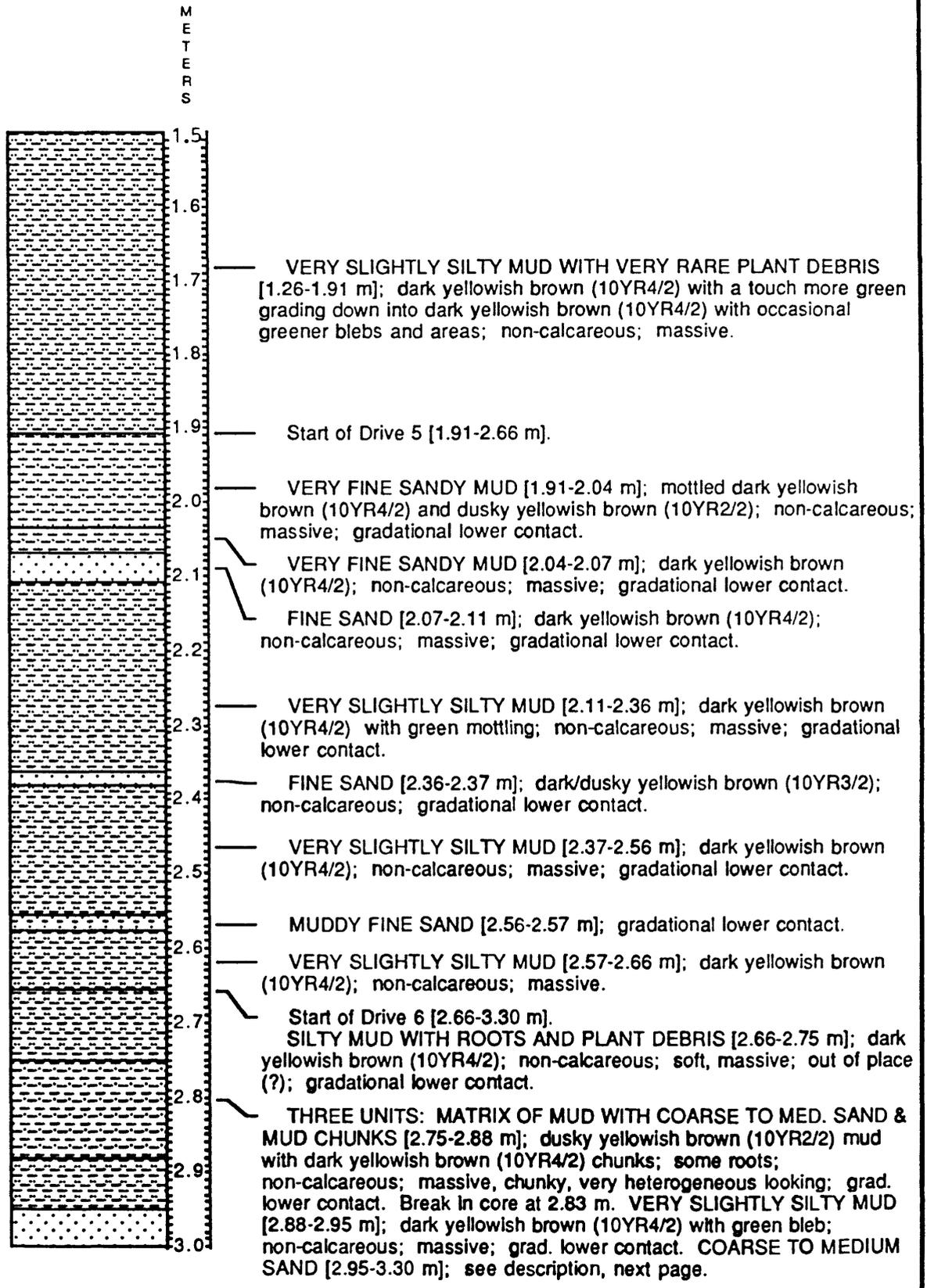


Appendix C
Core 2 Lithologic Log

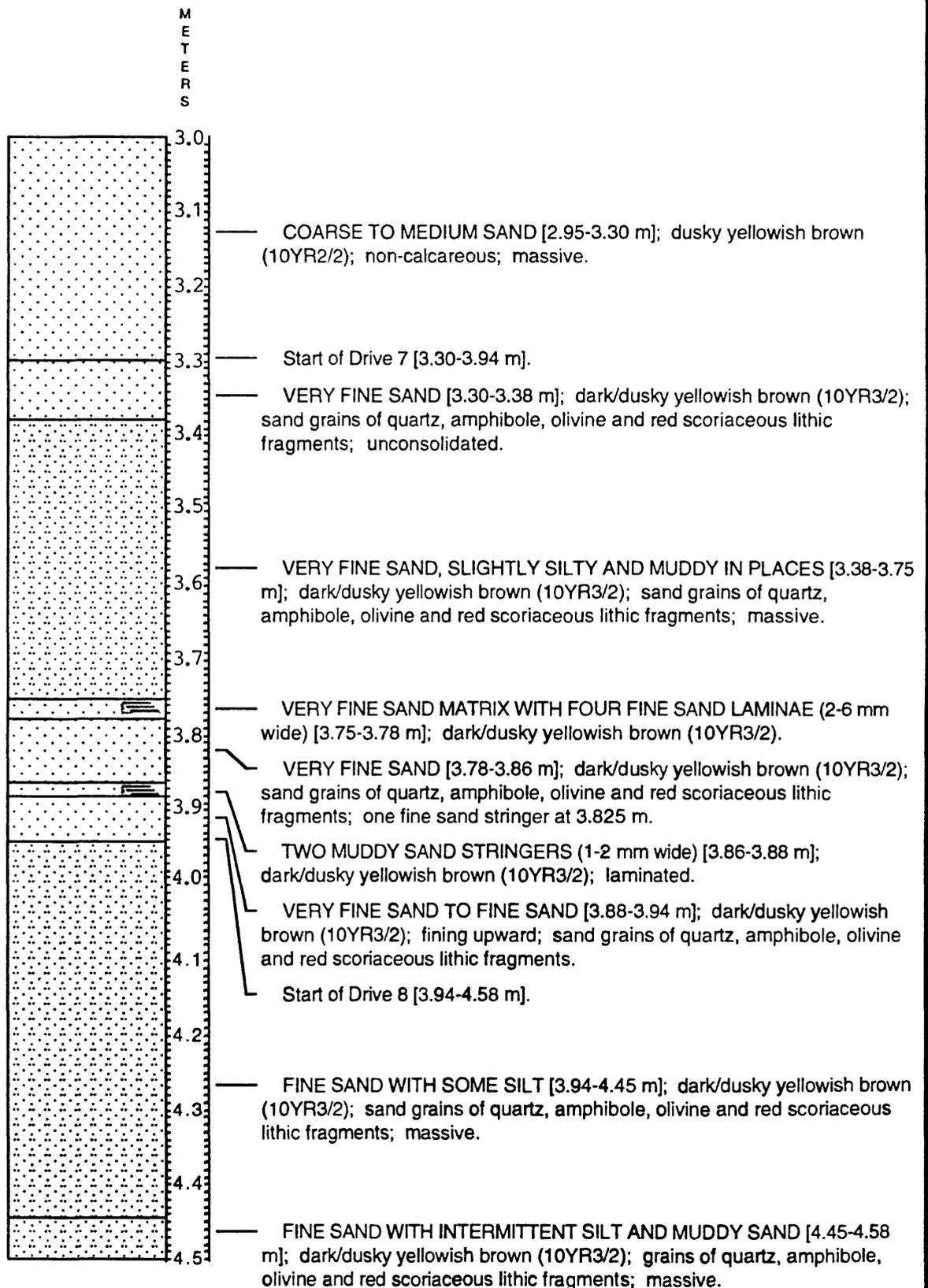
Grass Lake, Core 2 Siskiyou County, California



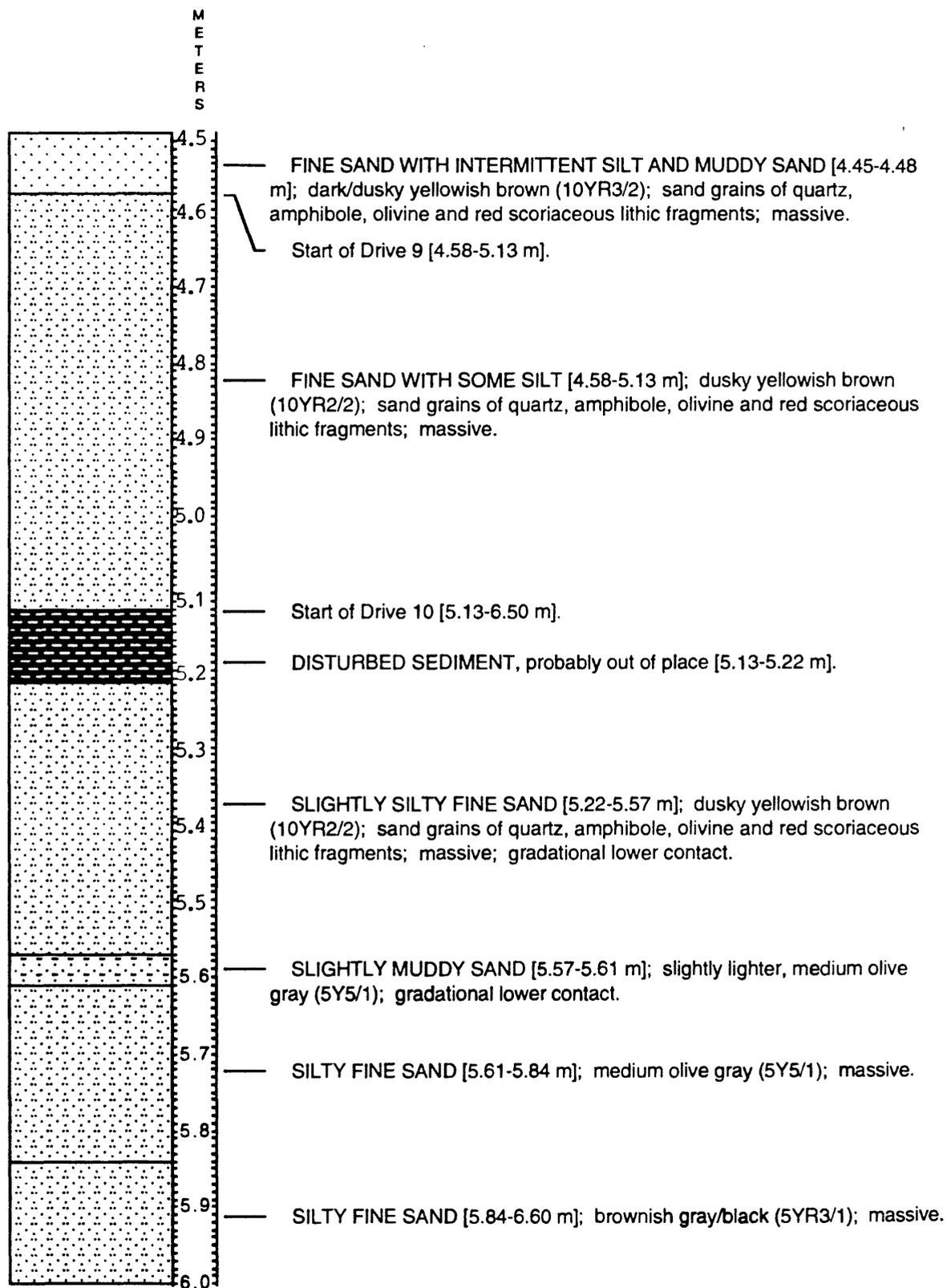
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Siskiyou County, California**



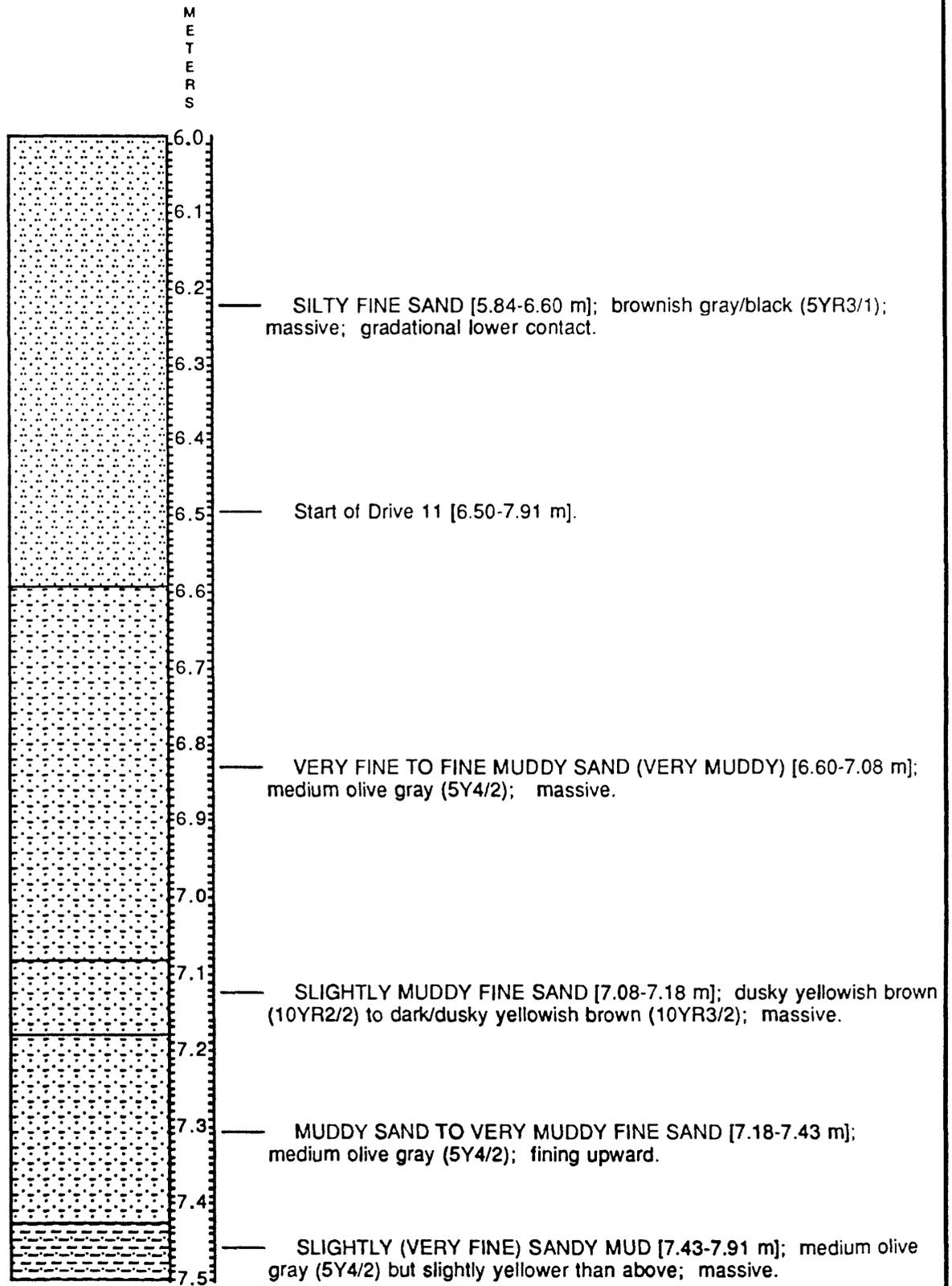
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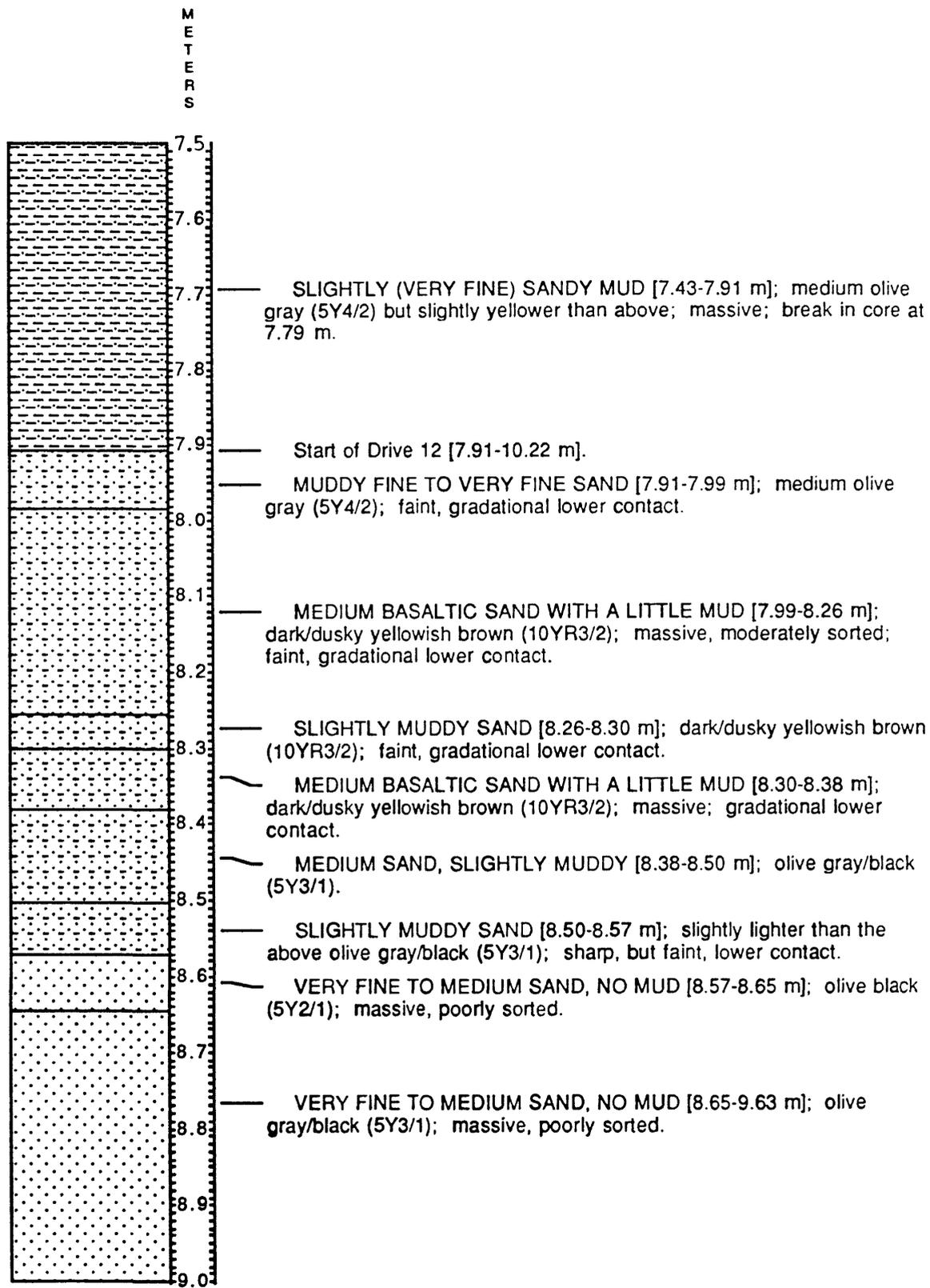
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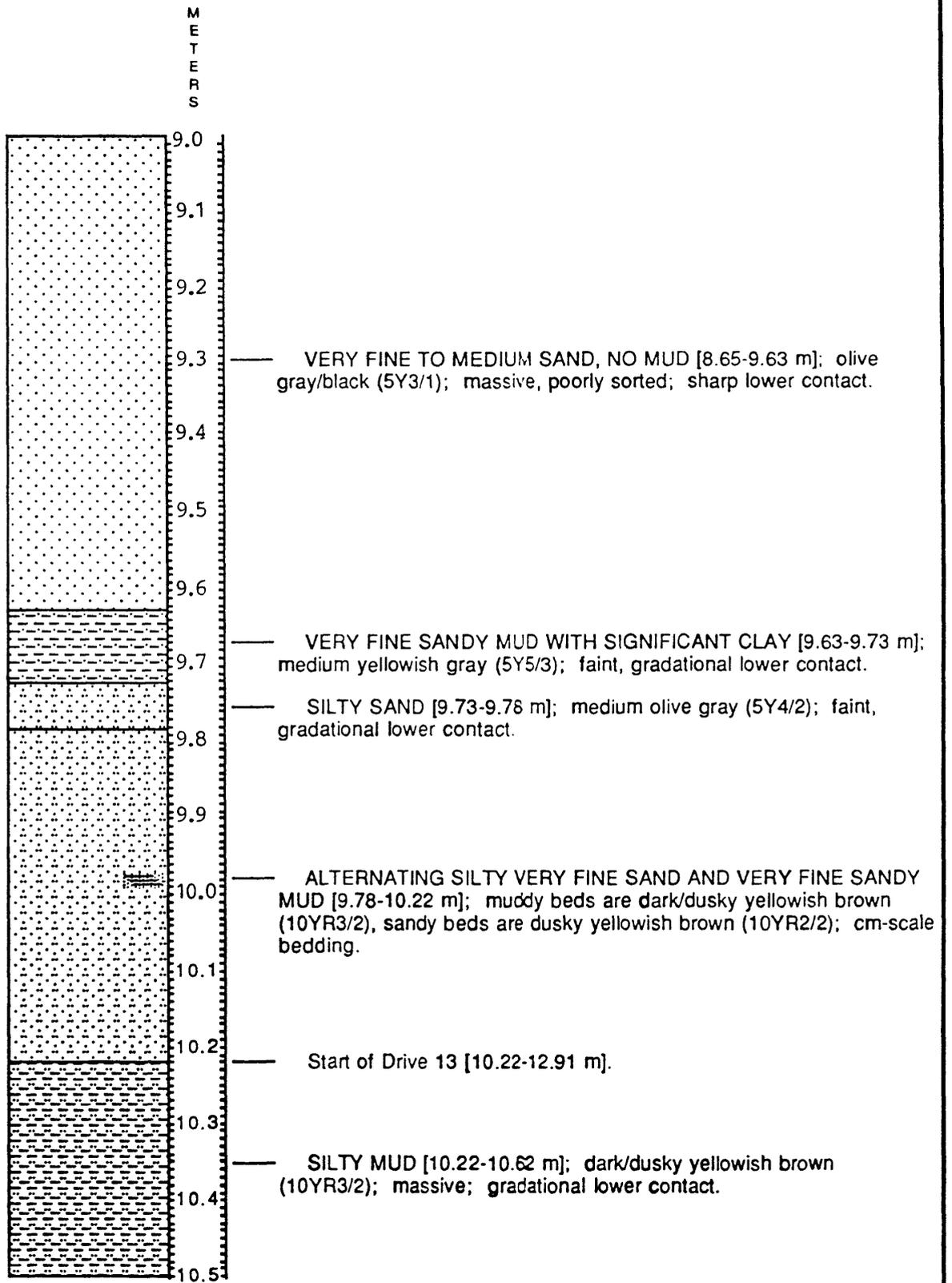
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Siskiyou County, California**



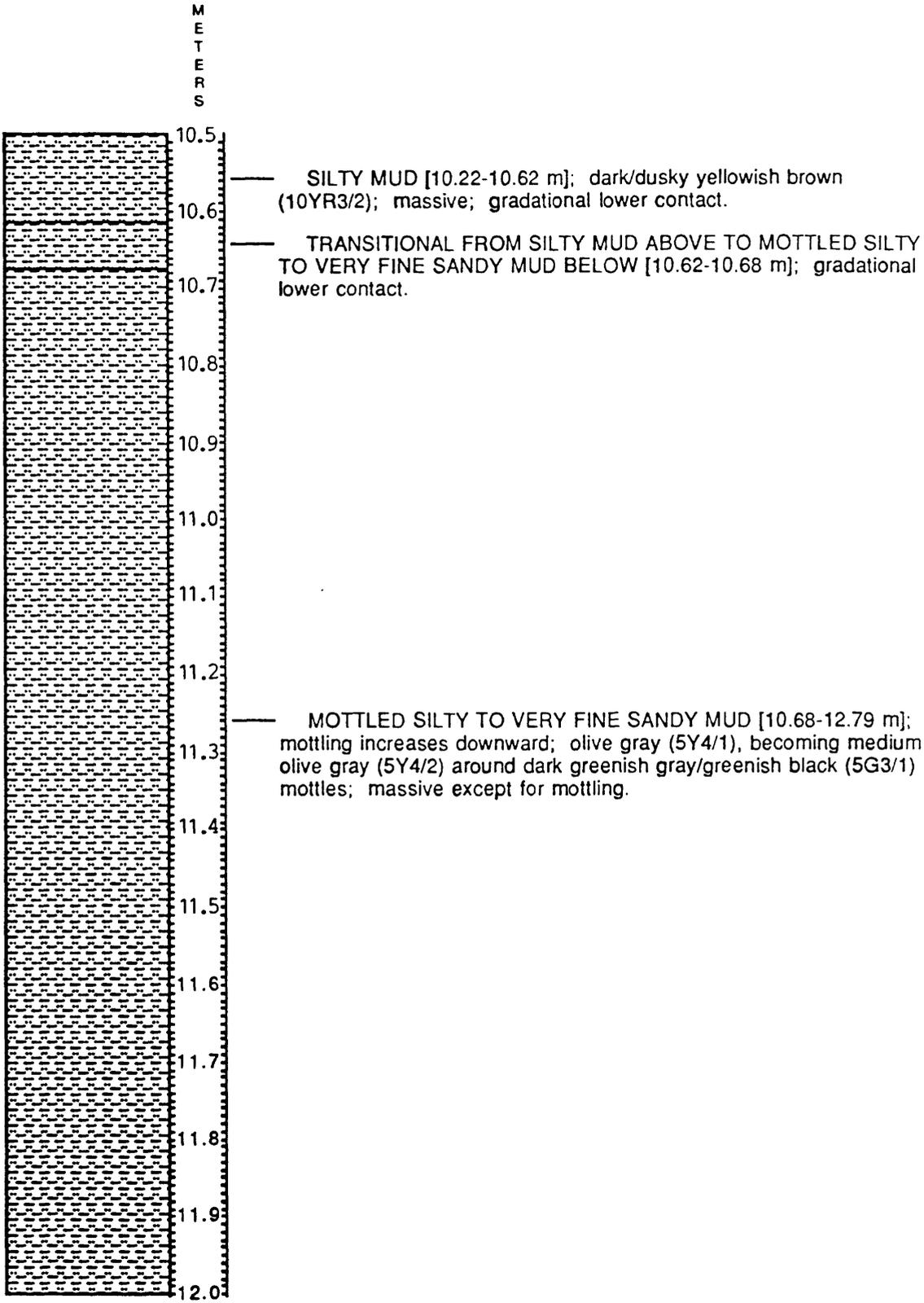
Grass Lake, Core 2 Siskiyou County, California



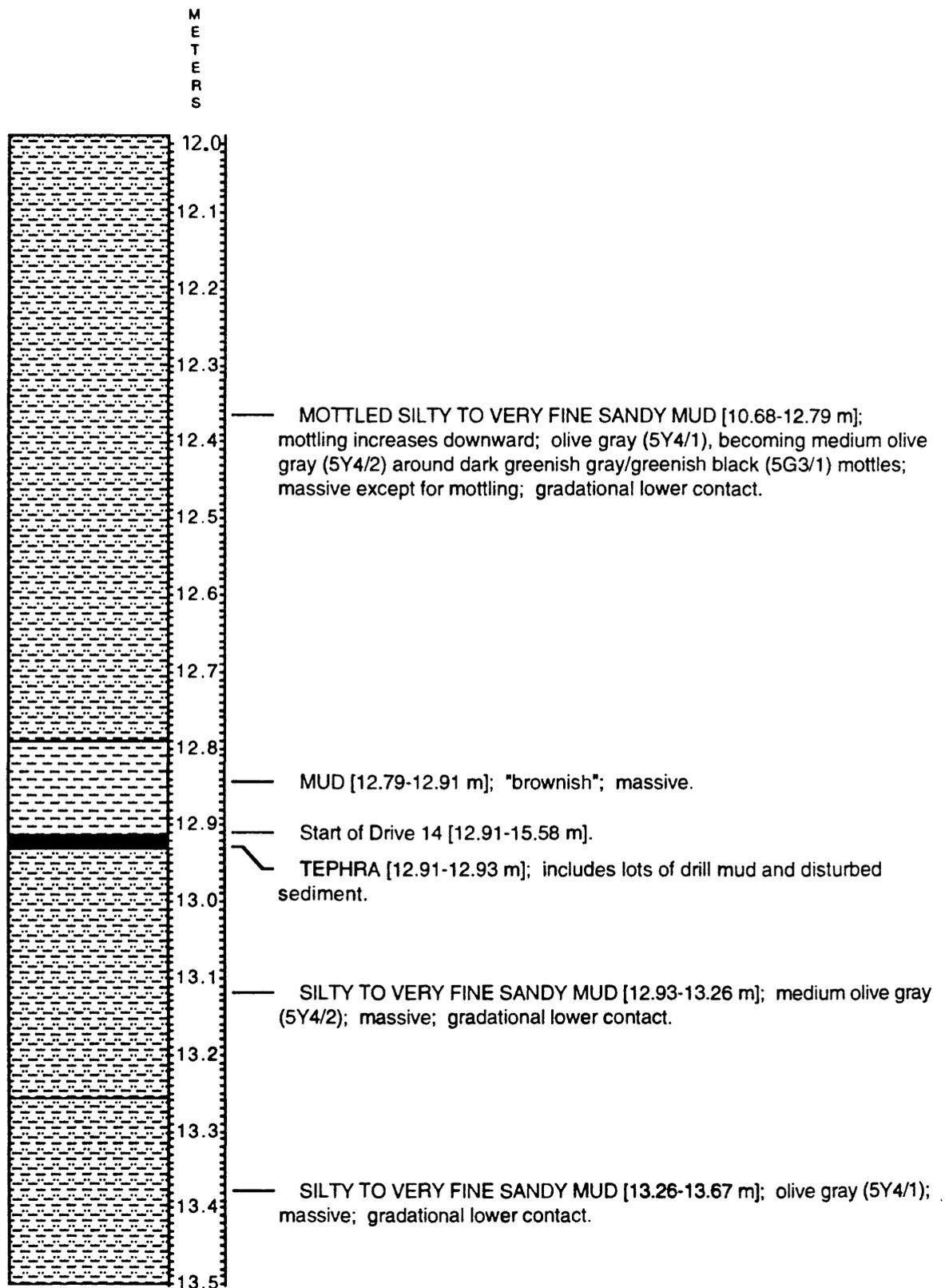
Grass Lake, Core 2 Siskiyou County, California



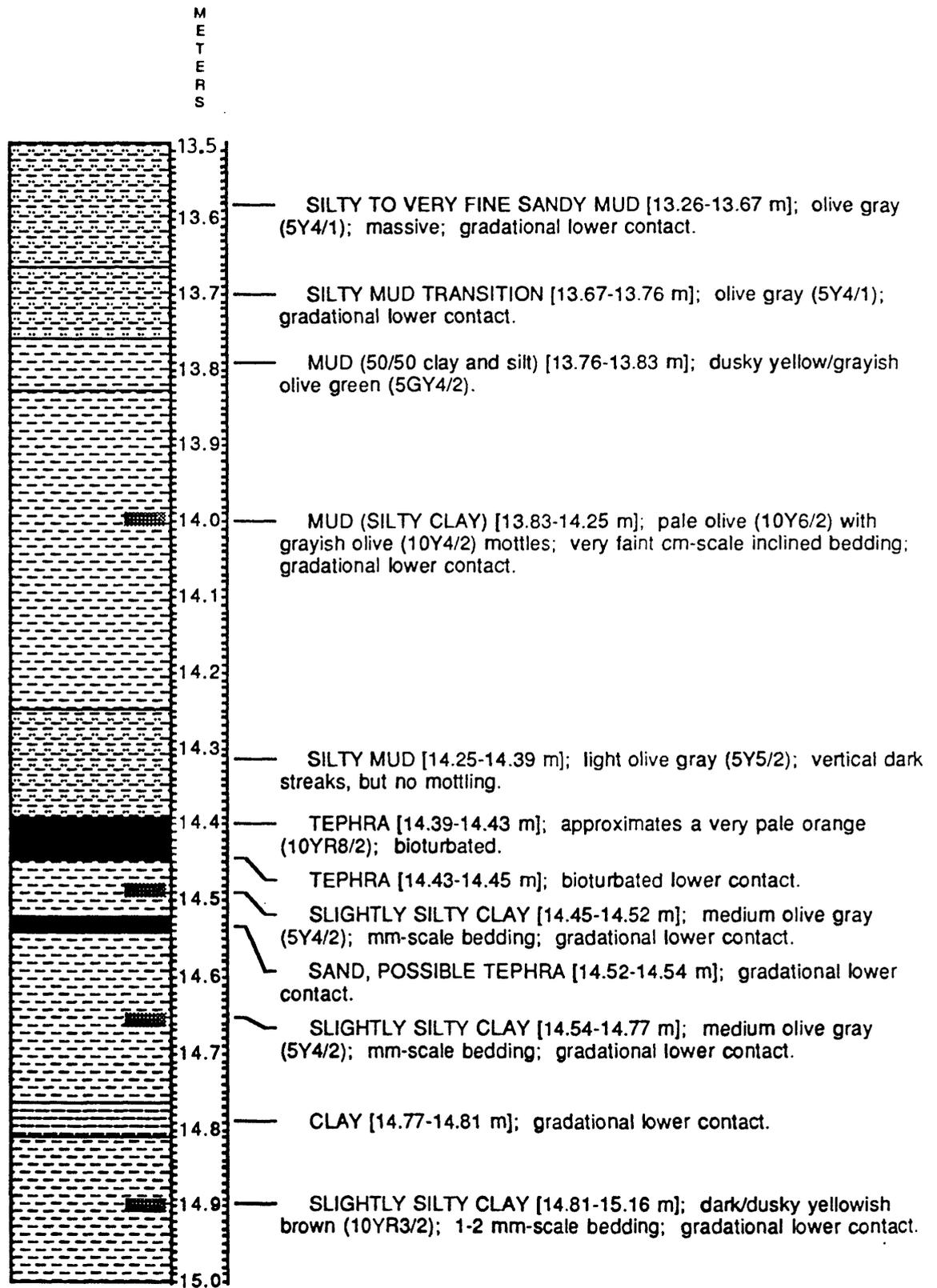
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Siskiyou County, California



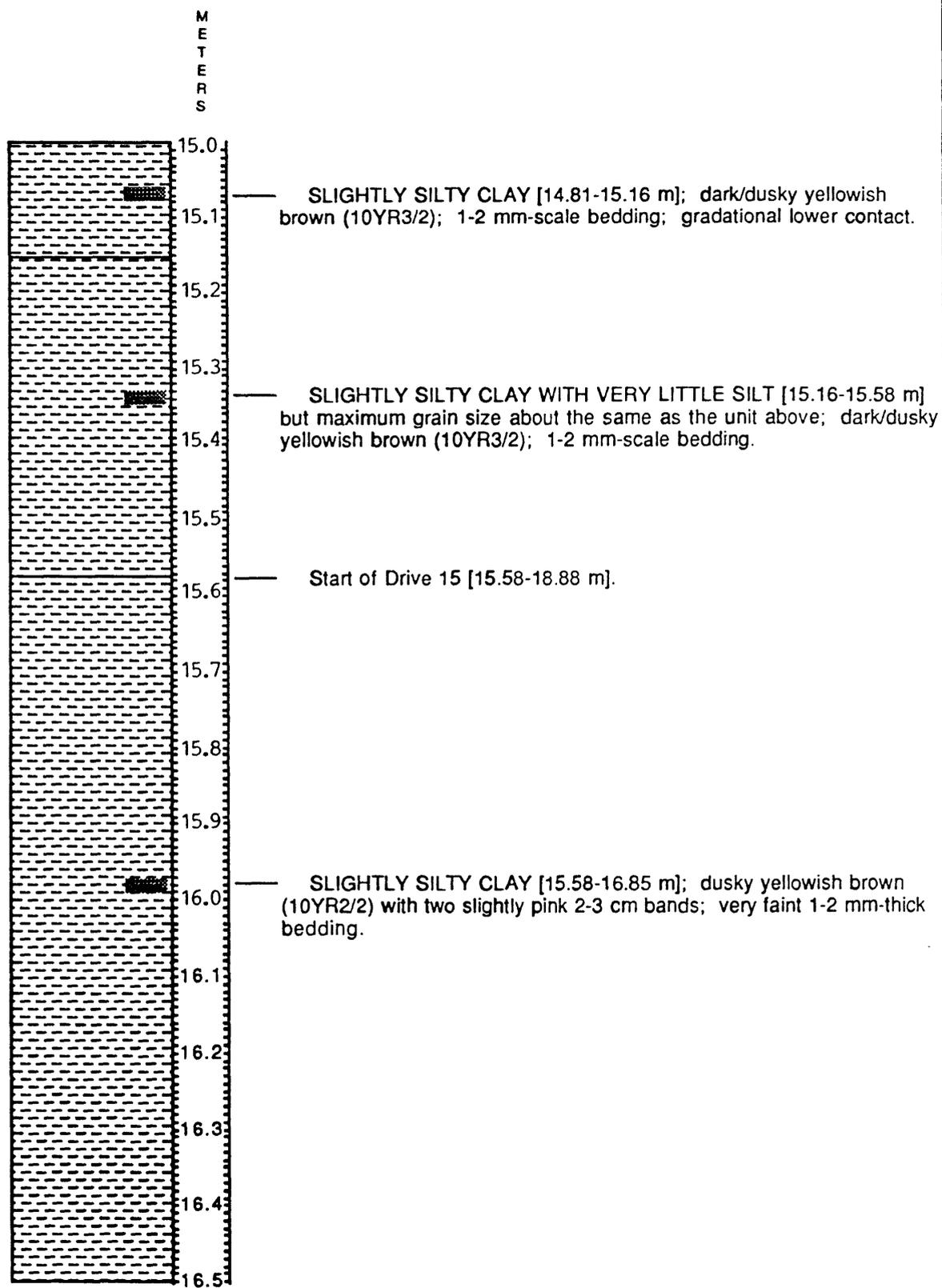
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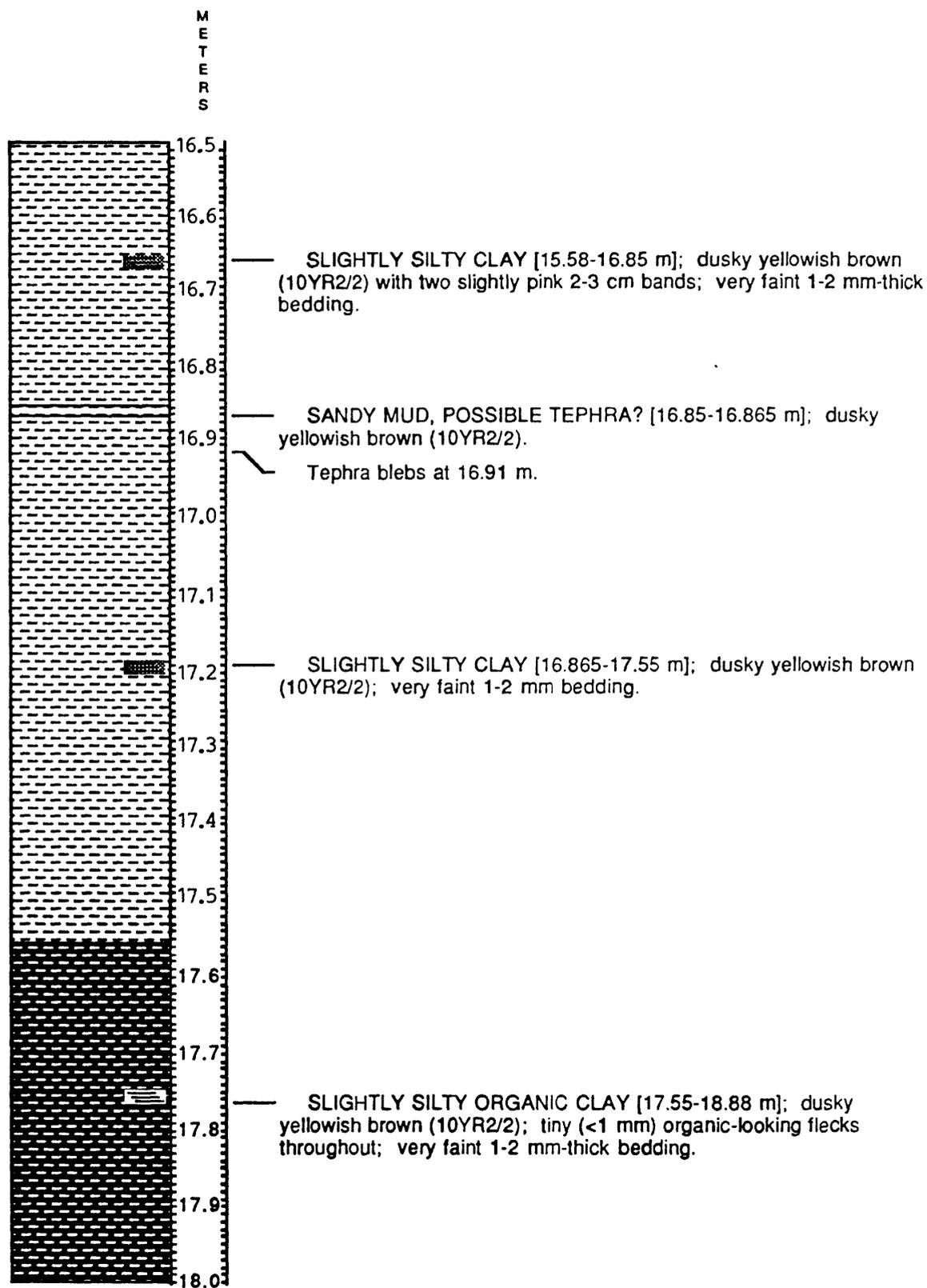
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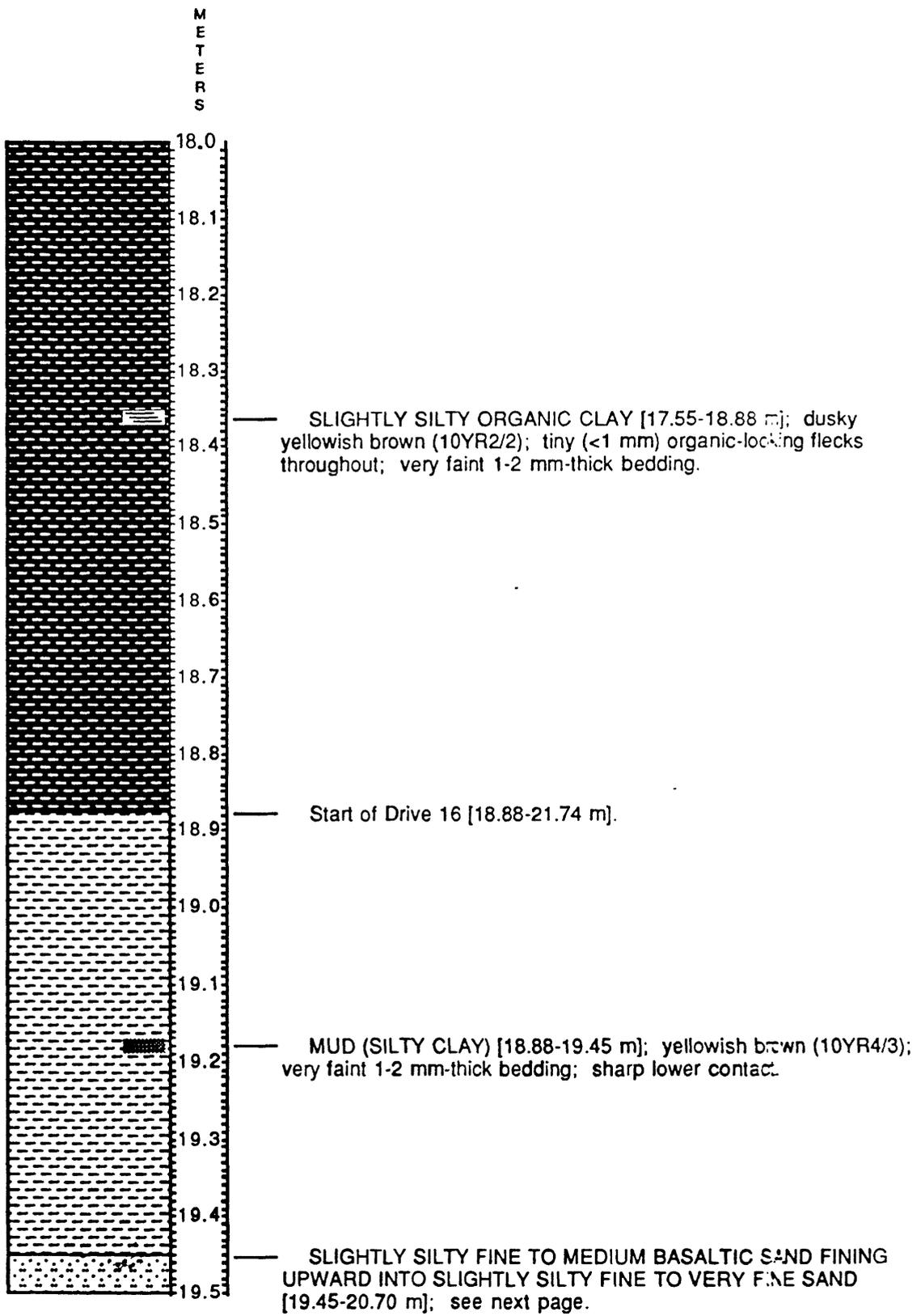
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Siskiyou County, California



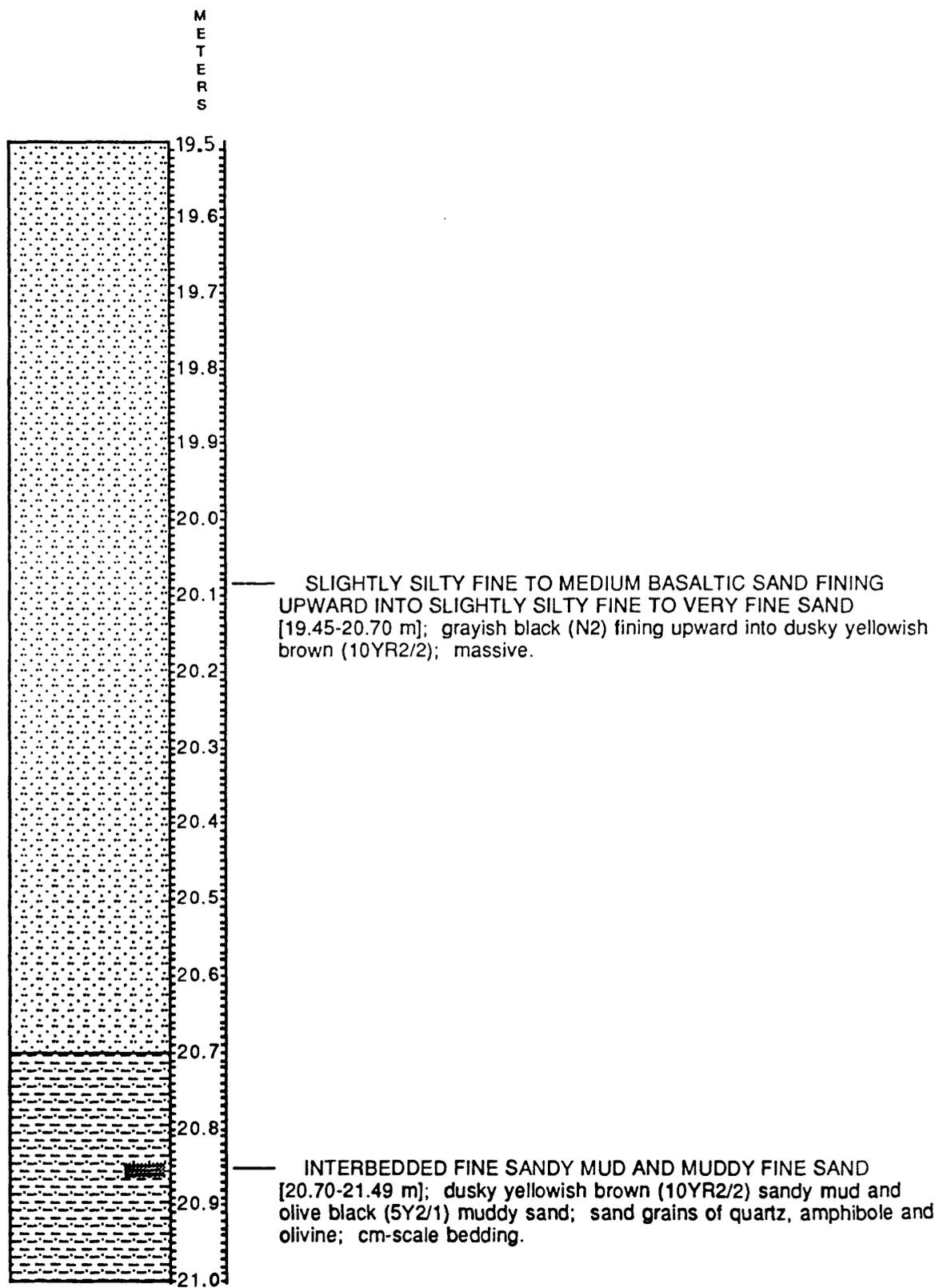
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Siskiyou County, California



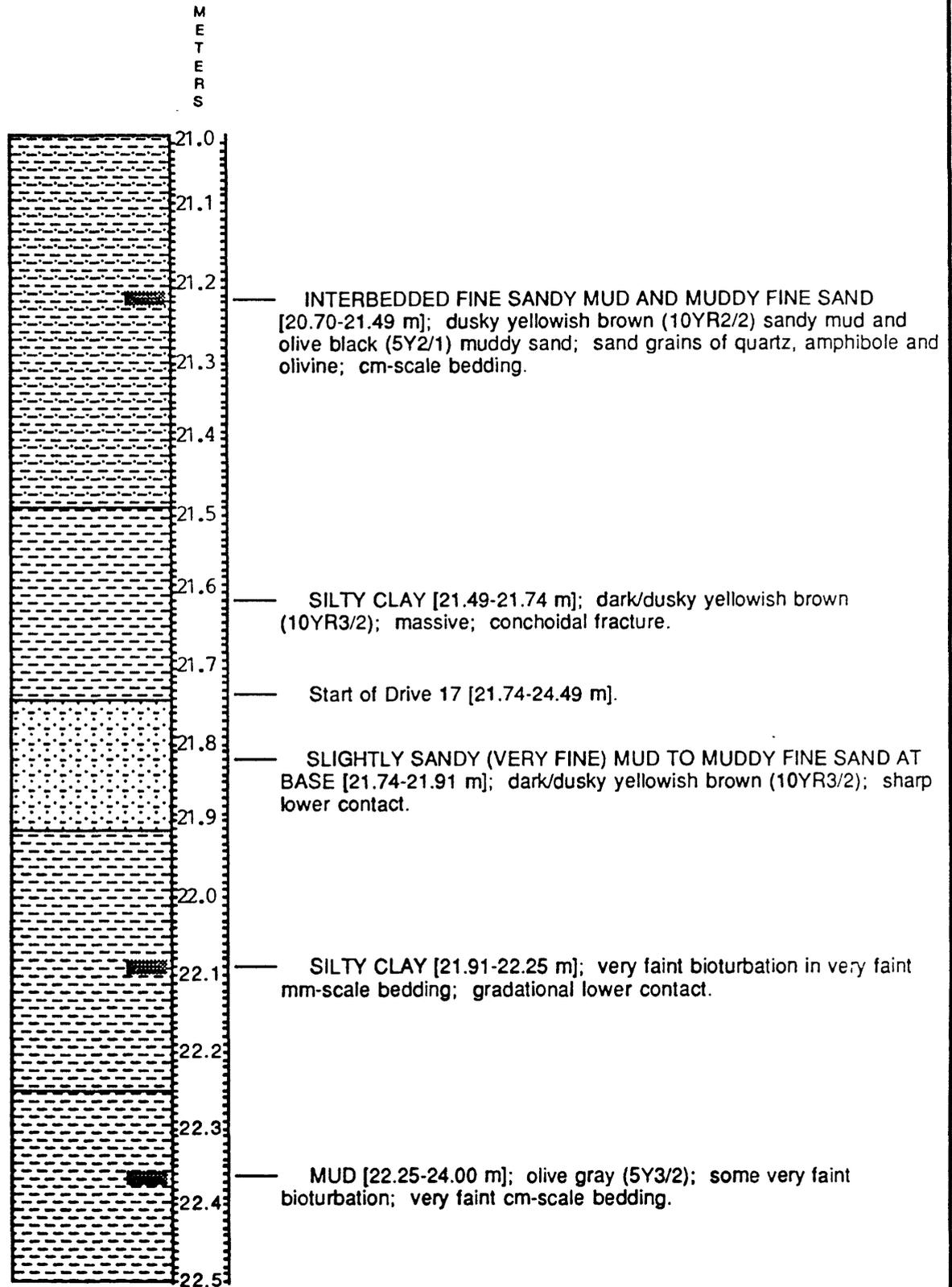
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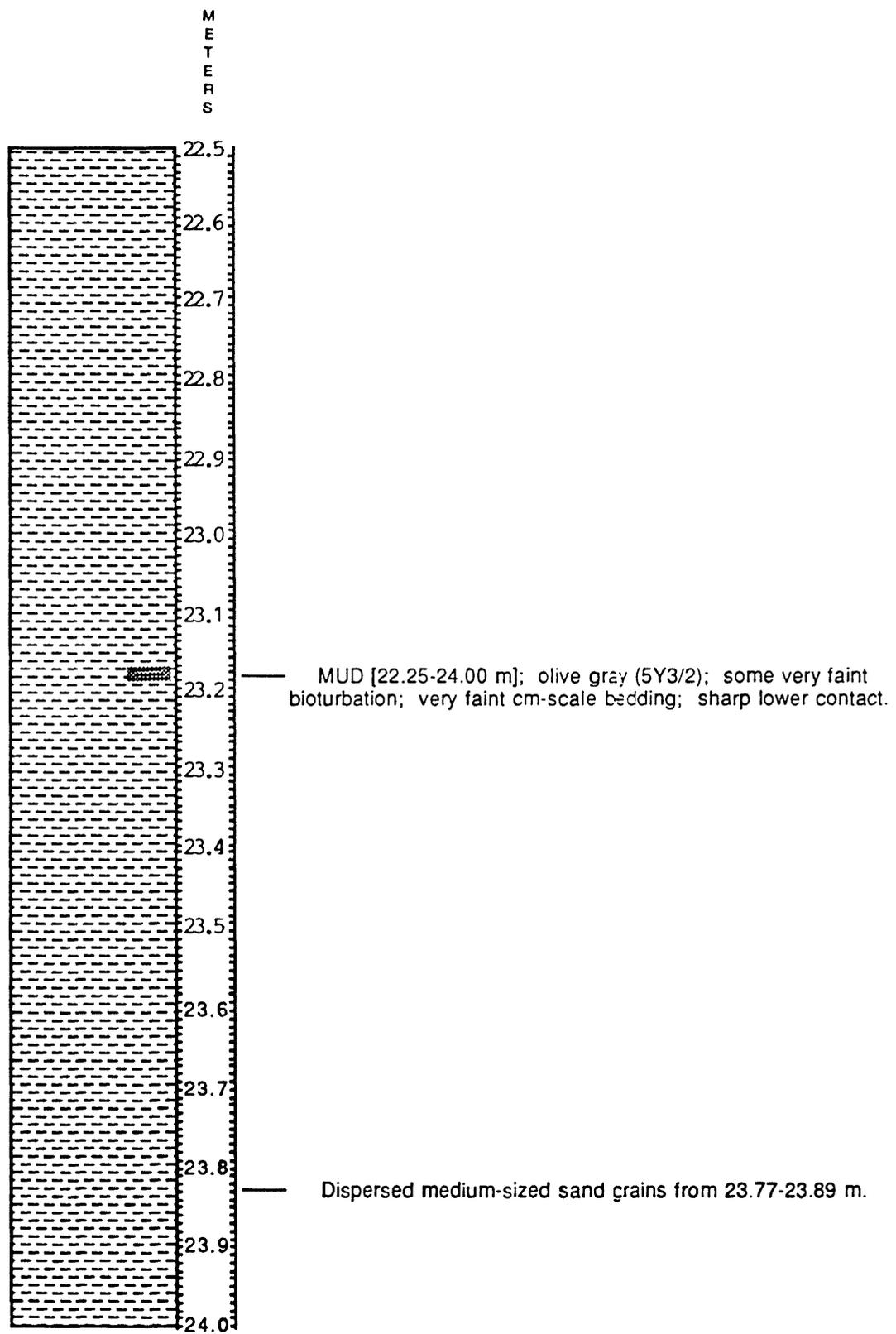
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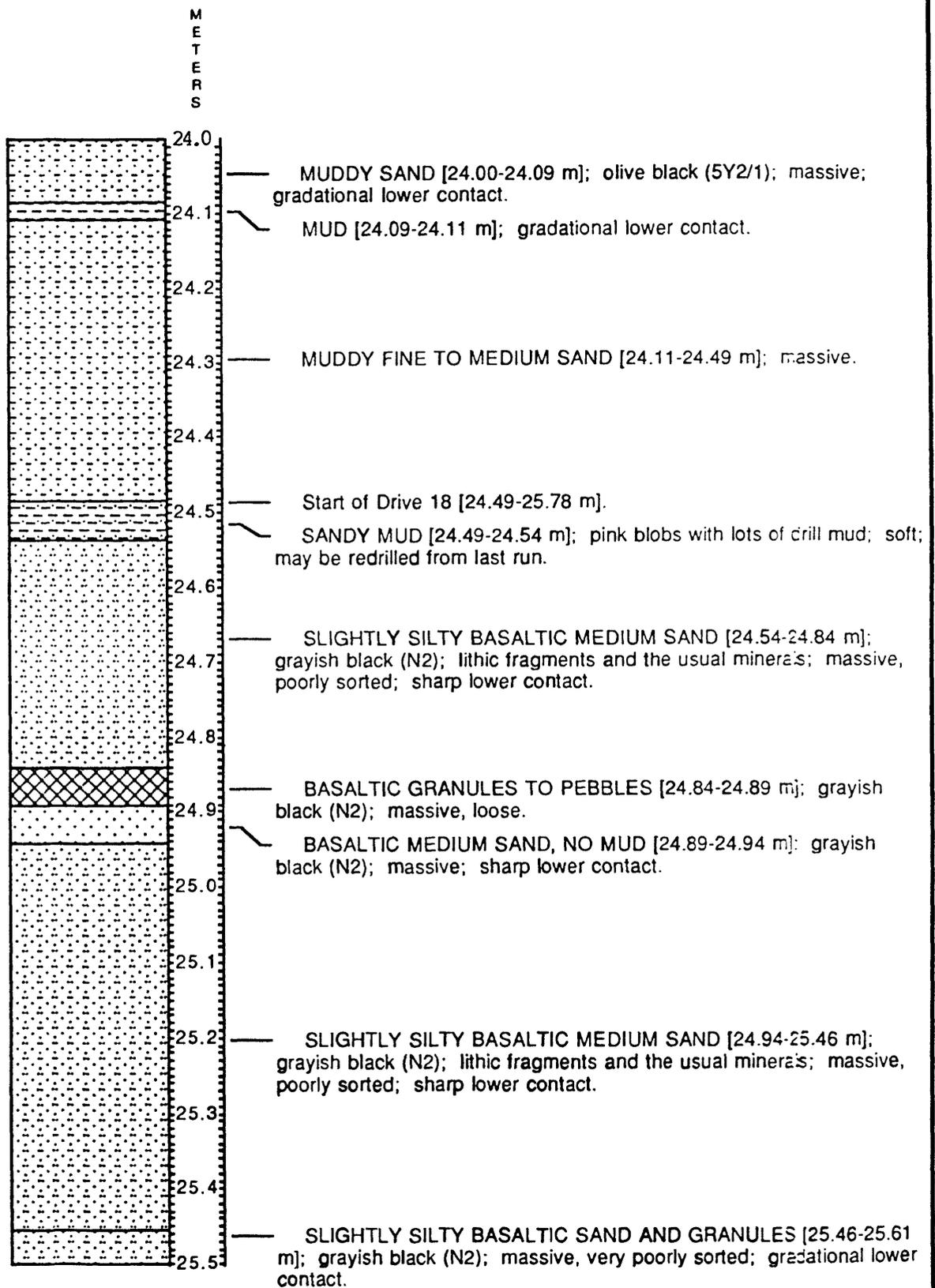
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Siskiyou County, California**



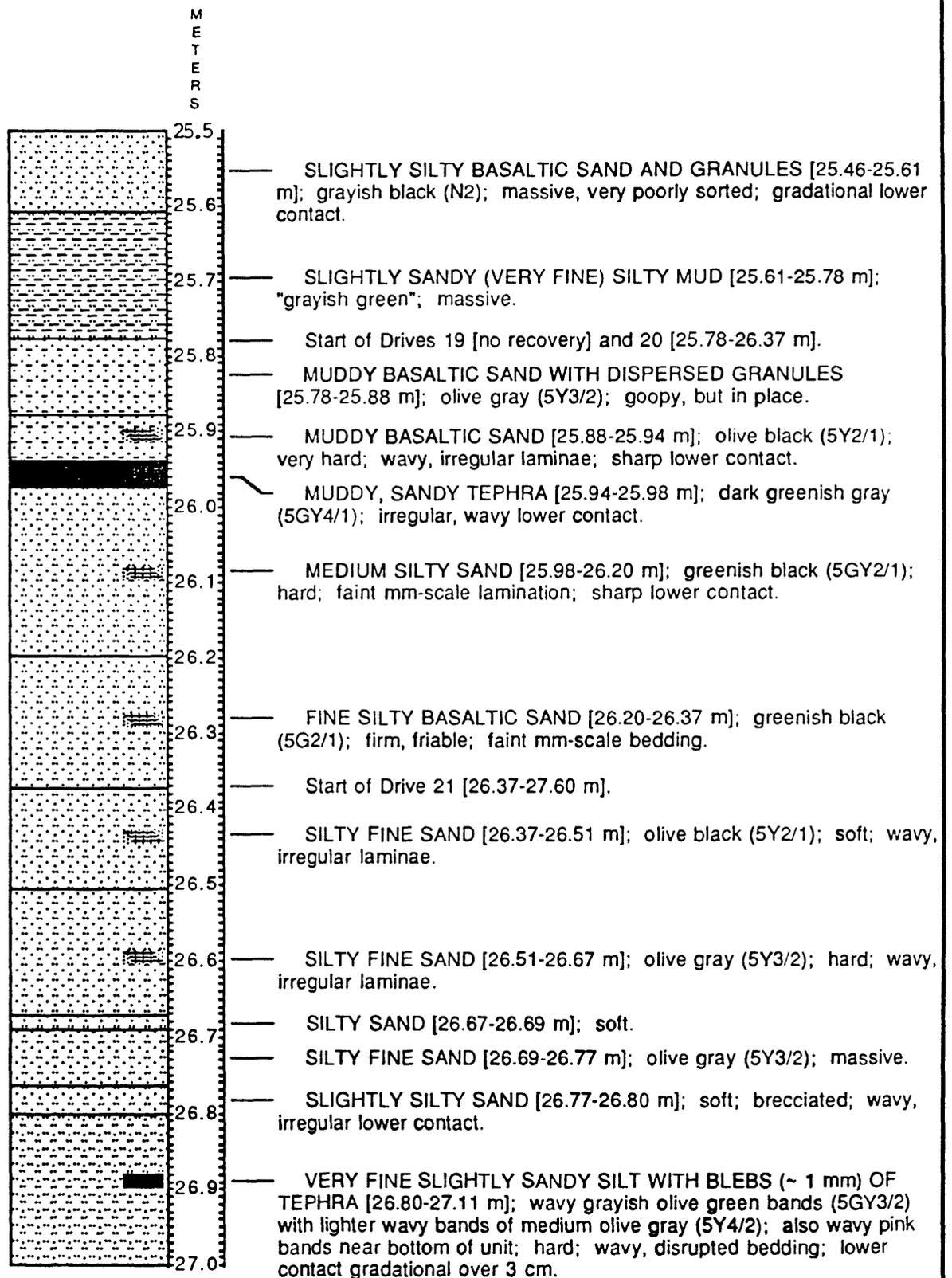
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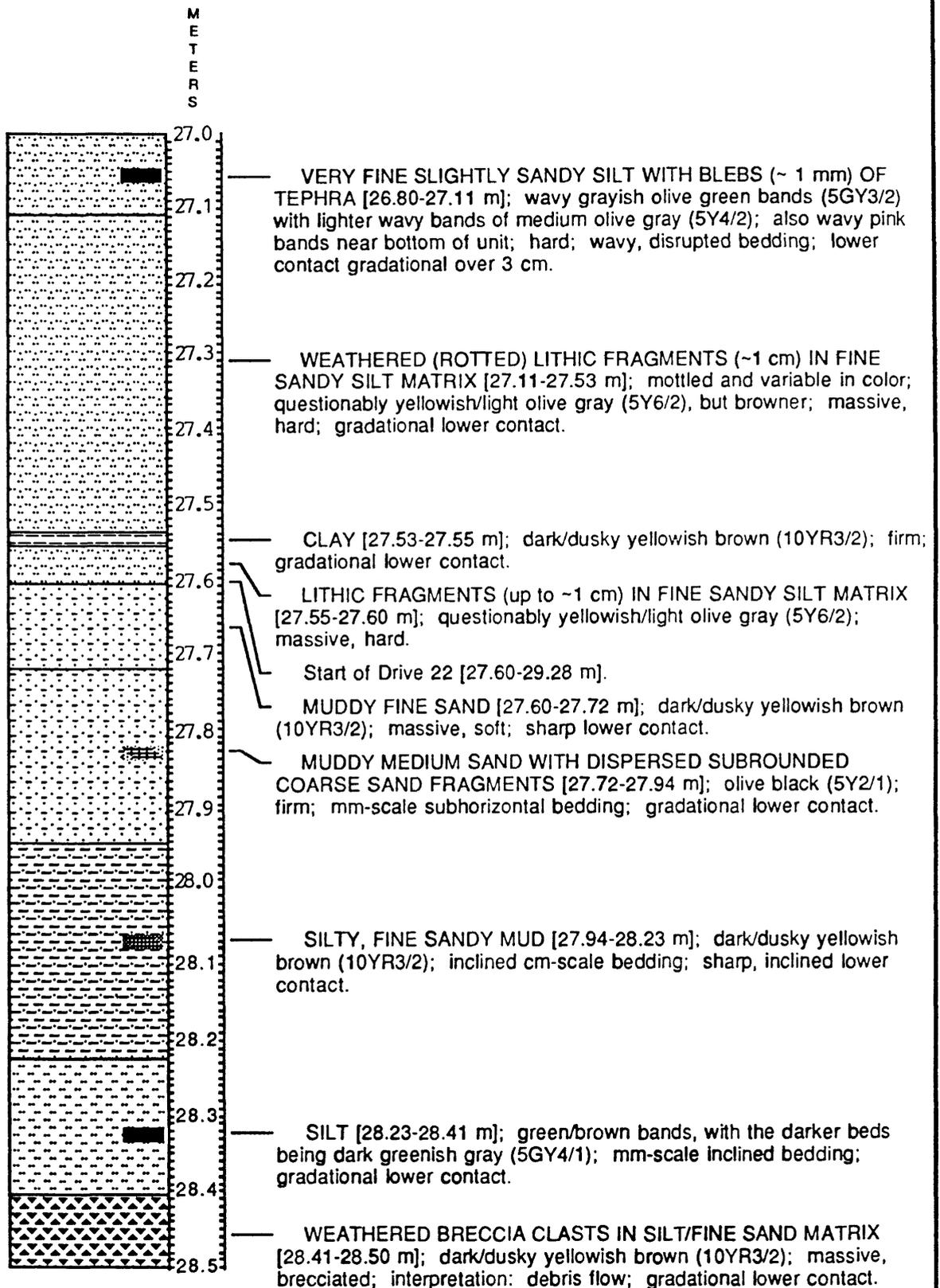
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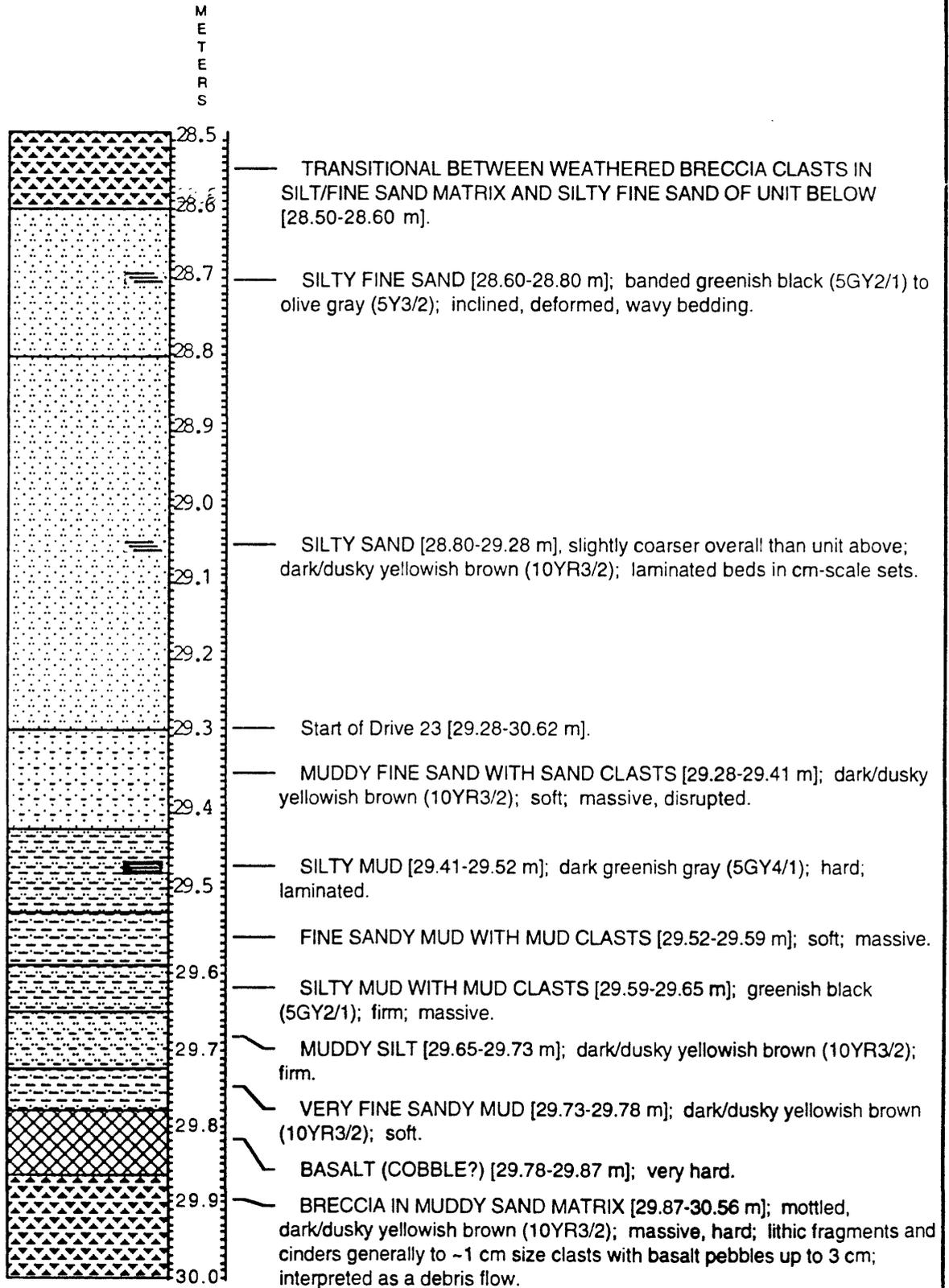
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Siskiyou County, California



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