$TR9$_ 132_ 142

19 ORE RESERVES IN THE CASCADE DEEP LEAD

by J. B. Braithwaite

ABSTRACT

An area near the town of Derby has been assessed for tin ore reserves with the result that a possible maximum of 2000 tons of tin has been estimated.

INTRODUCTION

Cassiterite was found by the Krushka Brothers in the Cascade River about the end of 1875 and the area seems to have been worked continuously, in varying degrees, from then until 1960. It proved to be by far the greatest alluvial tin deposit in Tasmania, and, although records prior to 1900 are meagre, the total production was in the region of 20,787 tons of tin metal.

Table 1 summarizes the information available as regards production, values and labour employed.

The area is still held under Mining Lease by Briseis Tin No Liability, who have given permission for the publication of information contained in their old records.

The leases are on the edge of the town of Derby on the Tasman Highway, 61 miles NE of Launceston.
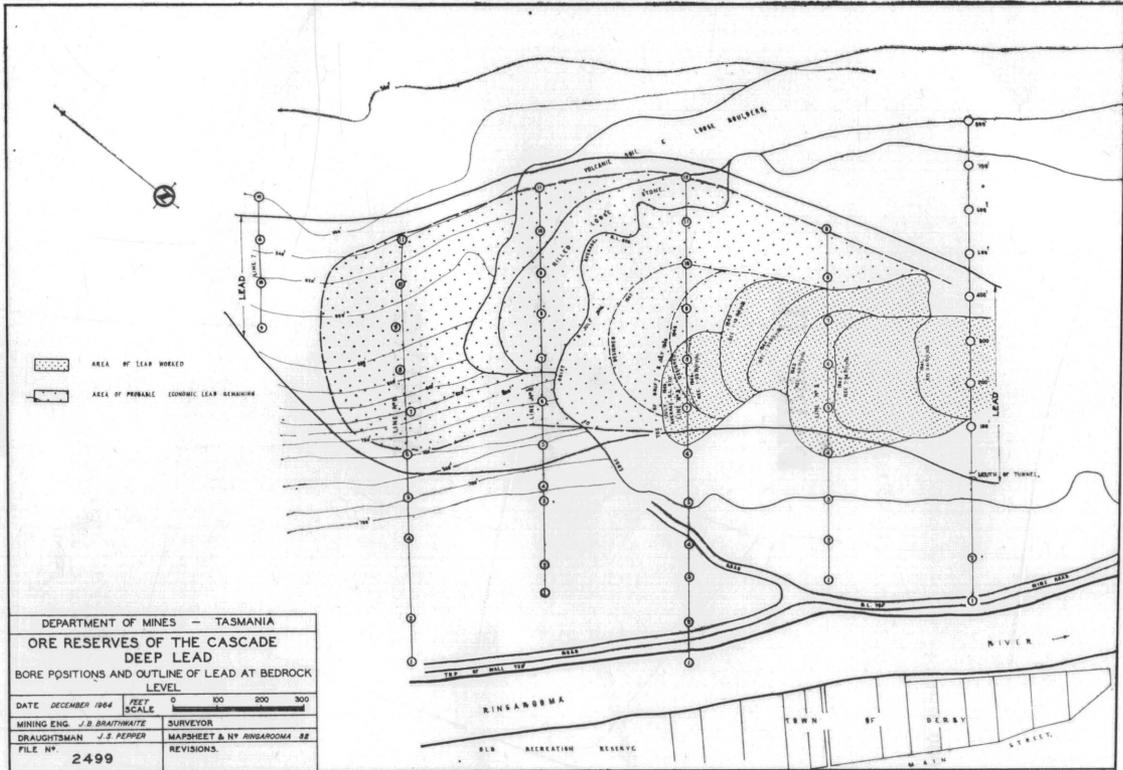
GEOLOGY

The early workings were shallow and rich and thus presented no difficulties but as they moved downstream it was realized that the main body of ore was a deep lead under the basalt. This lead occupied the old valley of the Cascade River, passed under the Ringarooma River (present) and was presumed to join the old course of the Ringarooma well to the NW. The bottom of the lead is some 150 feet below the present Ringarooma River and to the NE is over 400 feet below the present surface. Nye (1924) identified the lead as of Tertiary origin, filling the old Cascade River valley to a depth of some 300 feet and overlain by 150 feet of basalt in several flows of late Tertiary age. The bedrock in the upper portion of the lead is granite but near the lower limit of the workings this gives way to sandstone older than the granite. All the evidence regarding the origin of the tin points to the granite and its associated mineralization.

PROSPECTING

Prospecting of the lead was by drilling at 100 feet intervals on lines 315 feet and 330 feet apart and the positions of these bores are shown on Figure 21. Along Line 2 a tunnel was driven at about RL 720 feet and hand bores were sunk from this tunnel, 4 inch casing being used for a start but dropping to 3 inches in the lower sections. Bore No. 6 on Line 6 was sunk in the same way but all the others on Lines 3 to 7 were put down with power drills starting with 6 inch casing and reducing to 5 inches and in some cases finally to 4 inches. The cross sections and bore values are

FIGURE 21.

DEPARTMENT OF MINES — TASMANIA

ORE RESERVES OF THE CASCADE
DEEP LEAD

BORE POSITIONS AND OUTLINE OF LEAD AT BEDROCK
LEVEL

| DATE	DECEMBER 1964	FEET SCALE				
MINING ENG.	J.B. BRAITHWAITE	SURVEYOR				
DRAUGHTSMAN	J.S. PEPPER	MAPSHEET & N° RINGAROOMA 88				
FILE N°	2499	REVISIONS.				

AREA OF LEAD WORKED

AREA OF PROBABLE ECONOMIC LEAD REMAINING

5 cm

FIGURE 22.

DEPARTMENT OF MINES TASMANIA.
ORE RESERVES OF THE
CASCADE DEEP LEAD.

Date 11·12·64.
Mining Eng. J.B.Braithwaite   Surveyor
Draughtsman. J.S.Popper   Map Sheet 8.10. Ring'a 32
Revisions.   File Nº 2501.
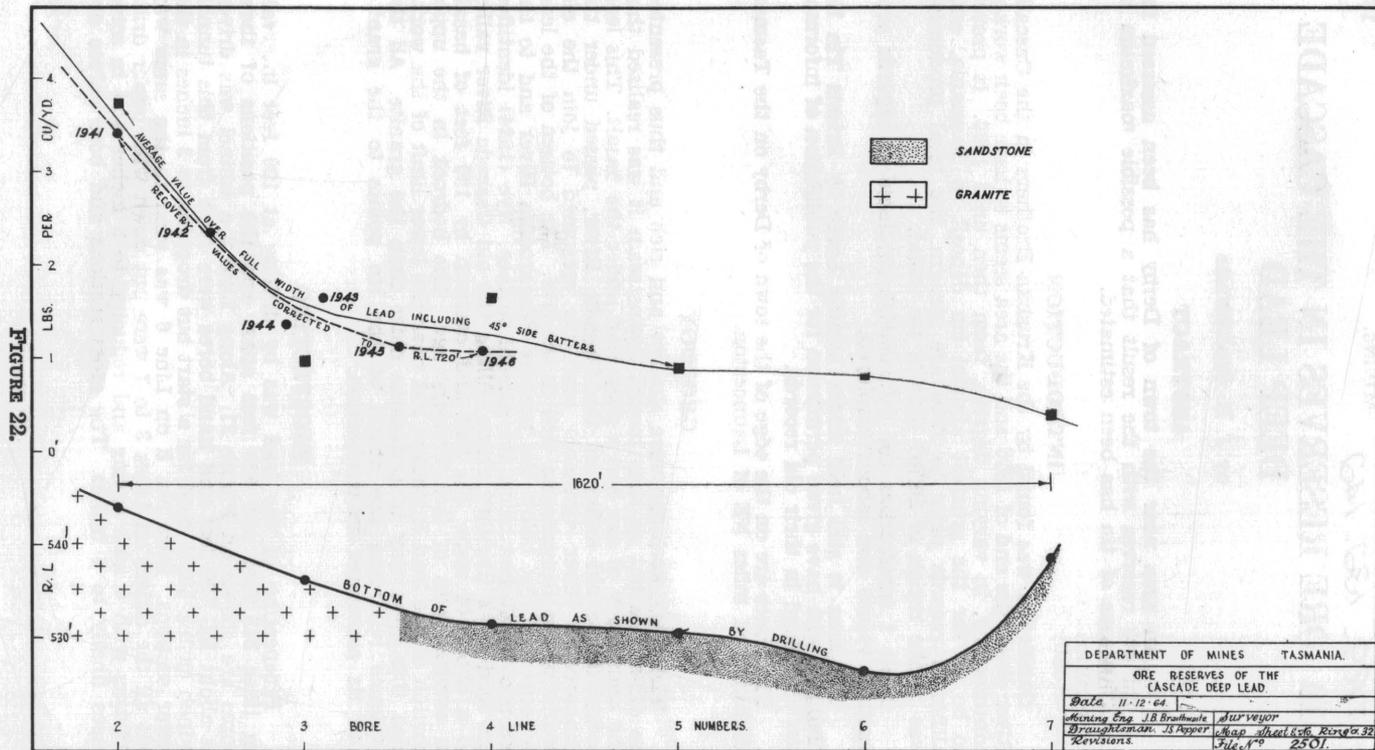
shown on Figure 32 and Table 2 shows various statistics based on the results. Figure 22 shows a profile along the deepest section of the lead, as indicated by the bores, and the corresponding average bore values over an assumed economic width (assuming a side batter of 45°).

The bore values shown on Figure 32 must be used with a certain amount of caution as they have been calculated on box measurements of the material recovered. The diameters of the casing used in each section of each bore is known but not the shoe diameters and hence it is not possible to calculate accurate core ratios. It appears that in tin-bearing ground the core ratios are usually better than 100% so that the calculated values of most 5 feet sections are more conservative than if a pipe factor had been used. In barren ground the core ratio is often very low and as total weight of tin and total box measurement had been used to arrive at average values these are often too high. The values of 5 feet sections on Figure 32 have not been corrected for assay but all average values have been corrected to 72% Sn. In the present calculations, values of 5 feet sections have been used to arrive at average values of bores, sections of bores and ore reserve blocks and corrections have then been made for assay. Table 3 shows a comparison of the two methods of calculating average values between RL 720 feet and bedrock. It will be seen that the present method gives lower values on the whole.

The economic portion of Line 2 was bored between 1907 and 1911 and Lines 3 to 7 between 1939 and 1941. The later series was done by one contractor and the bore logs are still available.

WORKING METHODS

The method of working adopted by Briseis Tin Consolidated No Liability was to break down the drift immediately below the basalt with hydraulic monitors, thus causing the basalt to collapse, pop any large boulders and remove the whole of the overburden hydraulically in a flume located in a tunnel. From the end of the flume fines went direct to the river while the oversize was stacked by a conveyor belt. In a similar manner the remainder of the drift was broken down by monitors and elevated to sluices by gravel pumps. Ample water at high pressure was provided by a 30 mile race from the Ringarooma River and a 2½ mile race from a dam on the Cascade River. Neither race is now in working order but the Cascade Dam remains and that system is capable of repair at reasonable cost. During the course of operations the Ringarooma River was diverted three times and although there were two disastrous floods which completely wrecked the plant and workings the present river diversion bund would appear to be well above any possible flood level.

The overburden face along the eastern side of the lead was very high and as the original overburden tunnel was not far in from this face the lateral extent of the workings on this side was restricted. With the construction of the new tunnel the workings were extended to the east but not to the full extent of the lead as the overburden had not been stripped far enough back. The use of water for the movement of both overburden and drift would tend to make the face unstable and it appears that even a batter flatter than 45° was insufficient.

The profit made by the Company in 1945 was small and it was realized that with decreasing values below Line 4 future operations were likely to be at a loss and an approach was made to Government for a free grant of £12,000 towards stripping, in order to regain control of the overburden and keep the mine in operation until 1948. An alternative proposal was to cease stripping overburden and merely mine as much drift as possible before closing down. While these discussions were proceeding some 1500 feet of overburden along the eastern wall collapsed and the workings were buried under 25-30 feet of slurry and rock. Some major items of plant were recovered but a great deal was lost and a committee investigating the possibility of re-opening the mine under Government control condemned the scheme as unsound.

Figure 21 shows the extent of the workings when mining of the deep lead ceased in the middle of 1946. It should be particularly noted that both Figures 21 and 22 picture the mine as it was just prior to the cessation of operations and that subsequently there was a large fall of overburden along the eastern face and extensive work was done on the shallow tin-bearing alluvium, particularly along the old river bed. The quantity of tin in the deep lead is, however, unchanged and also the total quantity of overburden to be moved although some of the latter may not be in the position shown in Figures 21 and 22.

ORE RESERVES

Figures submitted to the Investigating Committee in 1946 claimed reserves of 3,600,000 cu. yd. of drift going 0.9 lb./cu. yd. (cassiterite), a total of 1450 tons, but the committee considered 0.9 too high as it was based on the assumption that previous recoveries had been higher than bore values. The then Director of Mines claimed that a check indicated lower recoveries than bore values. In the 1946 estimate no calculation of overburden yardage was made and it was assumed that the ratio would be the same as in the past, i.e., about 32% and this would make the estimated overall value 0.68 lb./cu. yd.

Figure 21 shows the extent of the lead as indicated by previous boring, the area worked out, and the area remaining which could be worked, all at bedrock level. The total quantity of cassiterite proved by boring and remaining unmined when operations ceased in 1946 was 2200 tons but some of the higher level deposits have since been mined and the total now remaining is probably not more than 2000 tons, not all of which could be mined.

From Figure 22 it will be seen that, while in the vicinity of Bore Line No. 2 tin values are distributed over the full depth from RL 720 feet to bedrock, lower down the lead values are almost entirely below RL 600 feet. The present calculations are therefore based on the quantity of ore below RL 600 feet and that between 720 feet and 600 feet and the results are shown in Table 4. In this Table the overburden involved in stripping to a 45° batter is shown against the nearest bore in each case. The Table indicates that the best method of working under modern conditions with heavy earth-moving equipment would be to strip to RL 600 feet and treat the balance in a high efficiency jig, cyclone and table

plant. This would involve stripping 8,600,000 yards of overburden and treating 1,128,000 cu. yards of wash containing 3.20 lb. of cassiterite per cu. yd. The overall value of the ground to be moved in this scheme would be 0.37 lb./cu. yd.

It will be noted from Table 4 that bore values are erratic and that 6 bores account for 1000 tons of ore out of a total of 1600. Owing to the very large yardage represented by each bore it is extremely difficult to check past recoveries against bore values but an attempt to do this is shown on Figure 32. Recoveries for the years 1941 to 1946 have been adjusted to allow for the increased overburden ratio involved in stripping to RL 720 feet and plotted on the approximate positions along the lead. It will be noted that although the average value of Line 3 is very much below that of Line 4 this is not fully matched by a corresponding fall in recoveries and in fact recoveries fall off steadily and follow very closely the interpolated curve of bore values. It must also be remembered that the old plant consisted of sluice boxes only, and as the yardage handled was very large owing to the inclusion of so much barren overburden, the tin losses must have been high compared to what can be expected in a modern plant treating the wash only.

An alternative would be mining by underground methods but unfortunately the ore is not sufficiently concentrated on the bottom to make this practicable: 530,000 cu. yd. of drift could yield 1600 tons of cassiterite but the average depth to be mined would be 28 feet.

POSSIBLE EXTENSIONS OF LEAD

When the values fell off so rapidly below Line 2 the management at that time are believed to have considered the possibility that the lead had swung away to the right. A more reasonable explanation is that the deposit was formed in a lake and this would account for the rapid drop in values away from the inlet, the great width of the lead and the great change in the distribution of tin in depth from Line 2 to Line 7, i.e. in Line 2, there are values all the way down from RL 720 feet and 50% of the tin is more than 30 feet from the bottom while on Line 6 there is practically no tin above RL 600 feet and 50% of the tin is within 10 feet of bedrock.

Although it is unlikely that the lead was lost below Line 2 it is still possible that there are extensions to the right. There is no great rise in bedrock, as shown by the bores in Lines 3 to 7, which would indicate a definite boundary such as exists on the left, and further bores, particularly on Line 5, could show results. The bores on Line 7 show very little variation in depth and further boring in both directions is necessary to show whether this high bedrock does extend right across the lead. There is always the possibility that there is a narrow channel through this bar and that the lead will open out again below it as was the case with other leads in the district. Even if the deposit was formed in a lake there must have been an outlet and there could be an extension of the lead along this. Such a lead would be on a very much smaller scale but could be so concentrated, both in width and depth, that it would be an economic underground mining proposition.

Drilling to depths in excess of 400 feet, particularly where there is 150 feet of basalt capping, can be very expensive and an attempt should be made to project the bedrock profiles beyond the present bores and to try to find the lead beyond Line 7 by seismic or gravity surveys before trying out a new boring programme.

REFERENCE

NYE, P. B., 1924.—The sub-basaltic tin deposits of the Ringarooma Valley. *Bull. Geol. Surv. Tas.*, 35.

TABLE 1

PRODUCTION RECORDS

Period.	Tons of Tin.	Value (lb/cu.yd.) Drift only.	Overall.	Men Employed.	Remarks.
1876 to 1900-07	7100	3.41	2.09		Production outside Briseis Tin & General Mining Co. Ltd.
1900 to 1922	8935	3.41	2.09	....	Breseis Tin & General Mining Co. Ltd.
1923	254	....	....	91	
1924	179	....	....	126	
1925	140	....	....	120	
1926	118	....	....	99	
1927	184	....	....	104	
1928	217	....	....	102	
1929	89	....	....	61	Flood destroyed workings and plant
1930	45	....	....	25	
1931	43	....	....	34	Taken over by Briseis Tin Mines N.L.
1932	47	....	....	30	
1933	49	....	....	40	
1934	35	....	....	....	Briseis Tin Consolidated N.L. formed.
1935	18	....	....	....	
1936	55	....	....	103	Workings flooded.
1937	158	1.57	1.30	128	
1938	394	1.75	1.34	142	
1939	364	1.57	1.15	149	
1940	482	2.05	1.62	163	
1941	425	1.86	1.45	152	
1942	329	1.49	1.08	146	
1943	253	1.08	0.85	150	
1944	191	0.86	0.66	140	
1945	168	0.68	0.51	124	

1946	95	0.63	0.52	80	Work on main lead ceased.
1947	75	....	0.84	42	
1948	36	....	0.45	36	Briseis Tin N.L. took over.
1949	14	....	0.25	37	Main workings cleaned up and operations moved to Cascade River.
1950	40	....	0.74	N.A.	
1951	39	....	0.26	N.A.	
1952	39	....	0.26	42	
1953	26	....	0.21	40	
1954	40	....	0.22	39	
1955	33	....	0.27	39	Retreatment started.
1956	16	....	0.21	37	Cascade River workings finished.
1957	25	....	0.26	28	
1958	18	....	0.32	27	
1959	13	....	0.38	20	
1960	6	....	0.95	20	
	20787				

TABLE 2.

Summary of Bore Results in Tunnel Lines 2 to 7

Tunnel Line No.	2	3	4	5	6	7
Total depth of bores in lead (from RL 720 to bedrock)	605′	855′	1065′	1255′	1040′	545′
Width of lead	400′	500′	600′	600′	600′	300′
Average value of lead in lb/cu.yd of SnO_2 over all bores including a batter of 45°	3.74	1.06	1.77	0.92	0.87	0.42
As above but corrected to 72% Sn	N.A.	0.98	1.62	0.88	0.80	0.38
Depth of wash containing 50% of the ore	30′	5′	20′	15′	10′	10′
R.L. of lowest point of lead	544.0′	536.0′	531.5′	530.4′	526.1′	538.6′

TABLE 3

CORRECTED BORE VALUES—R.L. 720′ to bedrock.

1 Line No.	2 Bore No.	3 Dates of Boring.	4 Assay Value of Concentrates.	5 Corrected Values shown on Fig. 22.	6 Uncor'd Value re-cal'd.	7 Col. 6 corrected for Assay.	8 Depth below RL 720′
2 100′				2.92	3.11	....	157
200′				6.99	6.83	....	180
300′		not		4.86	4.86	....	175
400′		available		4.25	4.19	....	173
500′				0.51	0.52	....	163
600′				0.68	0.41	....	153
3	5	25.8.41–9.9.41	69.7	0.72	0.66	0.64	162
	6	4.8.41–25.8.41	66.6	0.93	0.85	0.79	171
	7	3.4.41–2.5.41	66.9	2.45	2.33	2.16	184
	8	15.3.41–2.4.41	71.7	0.82	0.82	0.82	185
	9	18.2.41–14.3.41	70.0	1.05	1.17	1.14	186
4	7	26.5.41–17.6.41	68.0	0.87	0.99	0.93	178
	8	22.4.41–26.5.41	66.8	1.48	1.61	1.50	180
	9	19.10.39–23.11.39	64.0	3.80	4.11	3.66	186.5
	10	29.8.39–11.10.39	71.6	2.70	2.49	2.47	180
	11	27.6.39–18.8.39	70.9	1.59	1.00	0.98	179
	12		64.2	1.12	1.13	1.01	164
5	5	20.10.41–29.10.41	73.5	0.29	0.22	0.22	168
	6	1.10.41–20.10.41	71.6	0.40	0.44	0.44	172
	7	6.9.41–3.10.41	70.1	1.48	1.90	1.85	189
	8	16.6.41–7.8.41	65.5	1.31	1.23	1.14	183
	9	12.6.41–17.7.41	67.8	0.77	0.68	0.64	178
	10	14.8.41–22.9.41	55.8	1.03	1.09	0.78	186
	11	1.10.41–6.12.41	68.7	....	1.03	0.98	182
6	6	6-7.39	66.2	0.32	0.24	0.22	158
	7	15.1.41–14.2.41	65.3	1.11	1.26	1.14	176
	8	21.8.40–12.9.40	61.5	0.57	0.58	0.50	169
	9	6.6.40–16.8.40	65.0	2.17	2.14	1.93	182

	10	30.9.	63.8	0.56	0.55	0.43	192
	11	14.12.39–13.5.40	64.7	0.94	0.83	0.74	170
7	9	5.8.40–5.9.40	67.3	0.31	0.44	0.41	178
	10	4.9.40–8.10.40	67.1	0.78	0.86	0.80	177
	11	17.10.40–21.1.41	62.2	0.50	0.38	0.33	180

TABLE 4
ORE RESERVES

		Below RL 600′			From RL 720′ to 600′			Above RL 720′
Line No.	Bore No.	Corrected Value (lb. cu. yd.)	1000 Cu. Yd.	Tons SnO$_2$	Corrected Value lb. cu. yd.	1000 Cu. Yd.	Tons SnO$_2$	Ovrbrdn. 1000 Cu. Yd.
3	8 } 9	2.68	84	100	0.13	60	3	330
4	6	0.00	2	0	0.00	6	0	....
	7	3.91	12	21	....	9	0	....
	8	4.24	32	60	0	10	0	....
	9	10.24	46	210	0.04	25	0	....
	10	7.36	65	215	0.04	80	2	15
	11	2.03	66	66	0.24	120	13	60
	12	3.73	22	37	0.20	120	11	900
5	5	0.48	13	3	0.08	133	5	60
	6	1.36	60	36	0.04	140	3	120
	7	4.92	83	183	0.08	140	5	120
	8	3.30	70	103	0.04	140	2	120
	9	1.84	70	58	0.05	140	3	125
	10	2.19	74	72	0.11	140	7	180
	11	1.21	50	27	0.08	140	5	1060
6	6	0.62	28	8	0.06	140	4	83
	7	3.00	65	87	0.07	140	4	240
	8	1.55	65	45	0	140	0	400
	9	5.80	73	190	0.02	140	1	446
	10	1.33	85	50	0.06	140	4	530
	11	2.10	40	38	0.08	110	4	1625
		3.20	1,112	1,609	0.08	2,213	76	6,414

ORE RESERVES
IN THE
CASCADE DEEP LEAD

FIG. 32

5 cm

LEGEND

v v v	MEDIUM BASALT
v v	HARD BASALT
(stippled)	TIN BEARING WASH

CROSS SECTION LINE 7

CROSS SECTION LINE 6

CROSS SECTION LINE 5

CROSS SECTION LINE 4

CROSS SECTION LINE 3

CROSS SECTION LINE 2
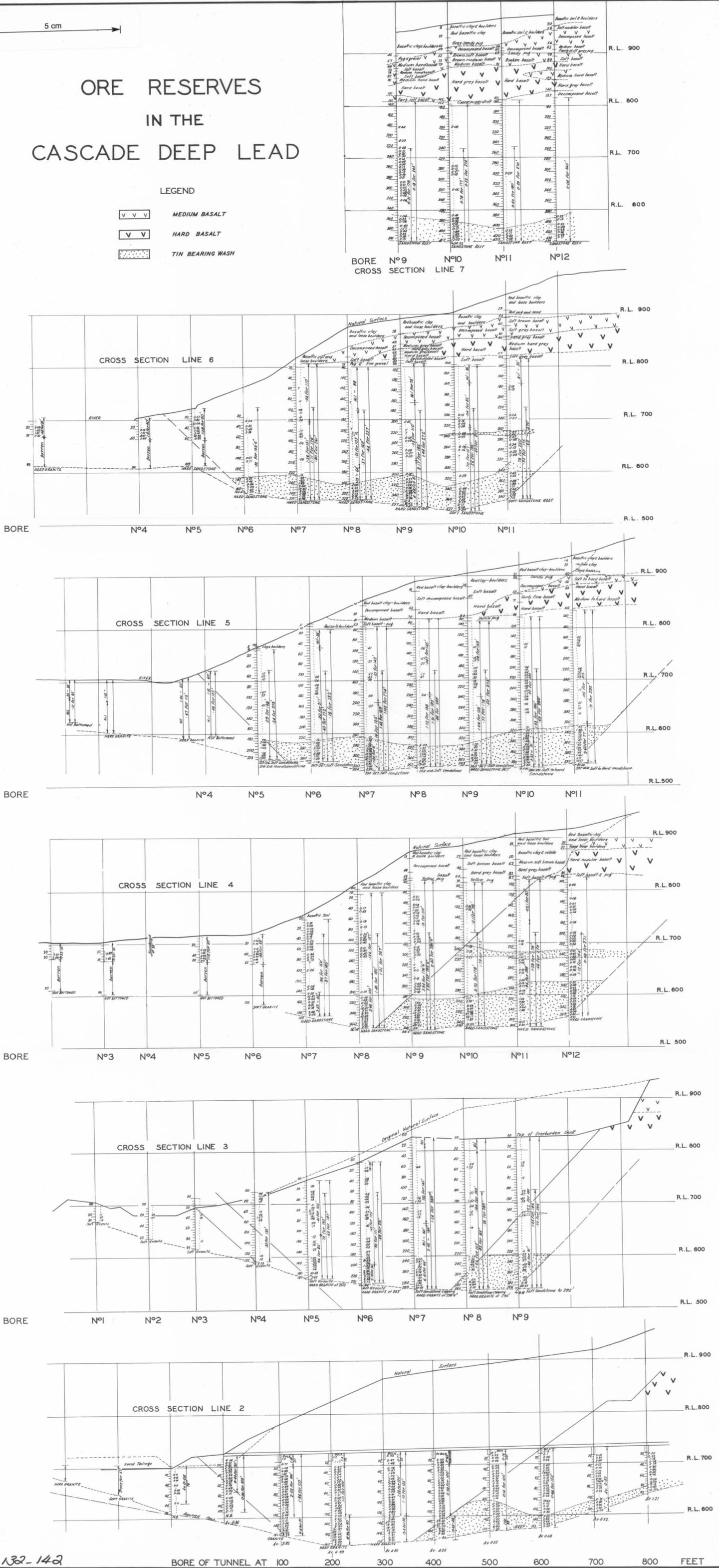
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BORE OF TUNNEL AT   100   200   300   400   500   600   700   800   FEET