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## SUMMARY

This study confirms the previous geochemical and EPR trends in the Pinnacles area. There is an EW geochemical halo characterised by enrichment in Mn and Zn, and high multiplicative indices of  $K \times Rb$ ,  $Mn \times Ba$ ,  $Zn \times Pb$  and  $Mn \times Ba \times Zn \times Pb$ . Based on the present geochemical and EPR data the possibility of significant mineralisation (economic deposit) in the Pinnacles area is unclear.

## RE-EXAMINATION OF ROCK GEOCHEMICAL AND ELECTRON PARAMAGNETIC RESONANCE (EPR) RESULTS (1994) IN THE PINNACLES AREA

### INTRODUCTION

This study sets out to re-examine the geochemical and EPR response in the rocks of the Pinnacles area presented by van Moort and Aung Pwa (1994). In other words this is an extension of 1994 research of which the geochemical and EPR results were mentioned in our previous report. Additional 19 rock samples were collected and analysed for K, Fe, Al, Ca, Na, Ti, Mn, Ba, F, Rb, Sr, Cl, Zn, Pb, Cu, Ga, Y, Zr, Nb, and V in the residual powder samples after hot HNO<sub>3</sub> leach by PIXE/PIGME at Lucas Heights, Sydney. EPR analyses were made by routine X-band EPR powder spectroscopy (JEOL JES FE3 X analogue spectrometer) in the Central Science Laboratory of the University of Tasmania. The distribution of some single and multi- elements and EPR intensities and index in the rock samples are studied to determine the previously defined distribution patterns of geochemical and EPR response. Fig. 1 shows 1994 study area, and sample points collected in 1995. The original 58 sample points are shown in Fig. 2. This report should be read in conjunction of the previous report.

### RELATION BETWEEN PREVIOUSLY DEFINED DISTRIBUTION PATTERNS OF ELEMENTS AND EPR INTENSITIES, AND GEOCHEMICAL AND EPR RESPONSE OF ADDITIONAL SAMPLES

This investigation is made to evaluate further the distribution patterns of single and multi-elements and EPR intensities reported in 1994.

There is a correlation between single element distribution (Mn, Ba and Zn) of previous and additional data (Figs. 3, 4 and 5). The zones of high values of Mn and Zn in the previously study area have a relation with the Mn and Zn values of additional samples. The majority of new samples within the high Mn and Zn zones also exhibit moderate to high values.

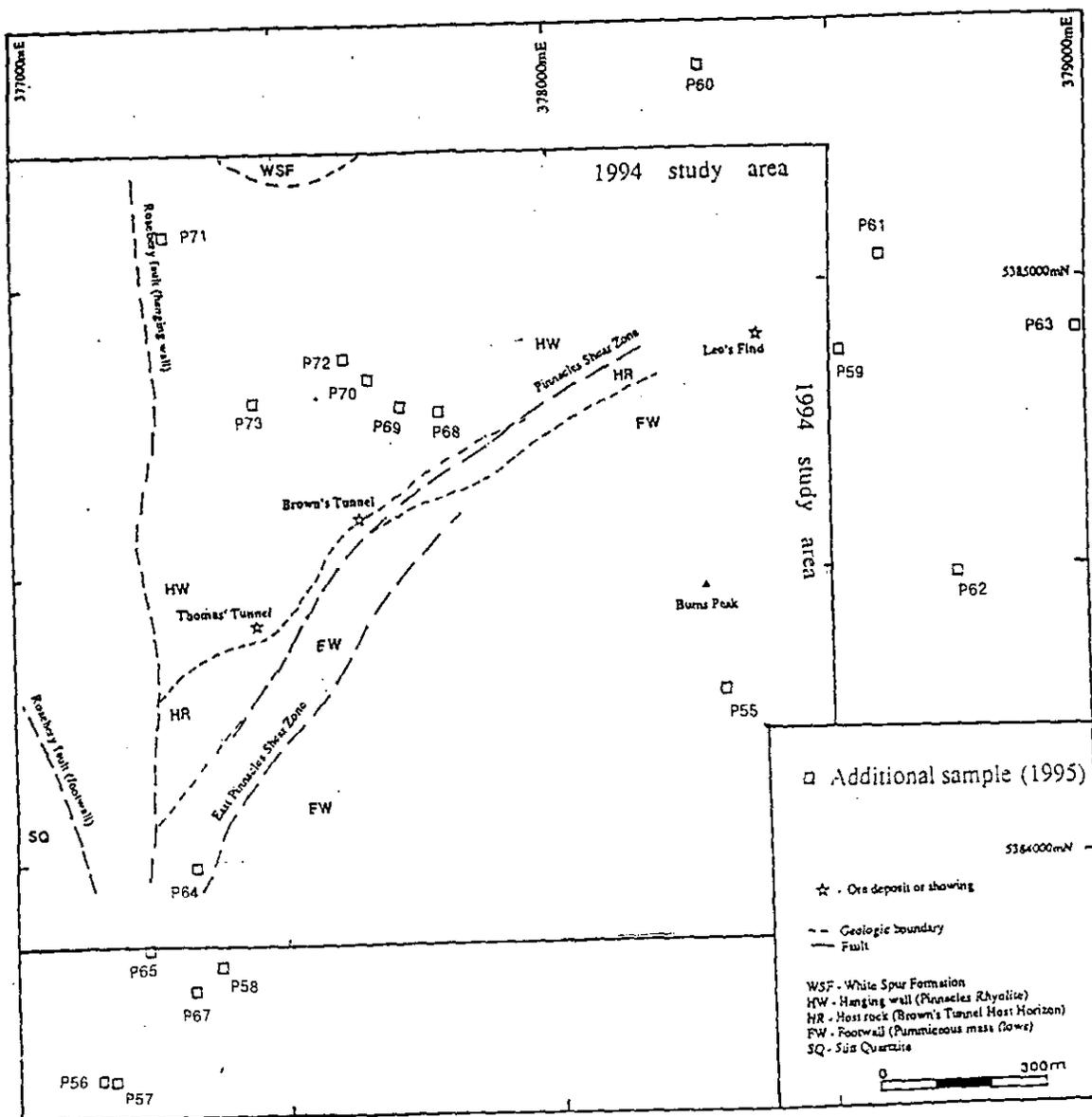


Fig. 1. Locations of additional surface rock and drill core samples in the Pinnacles area collected in 1995. For the locations of the original samples in the smaller area see Fig. 2.

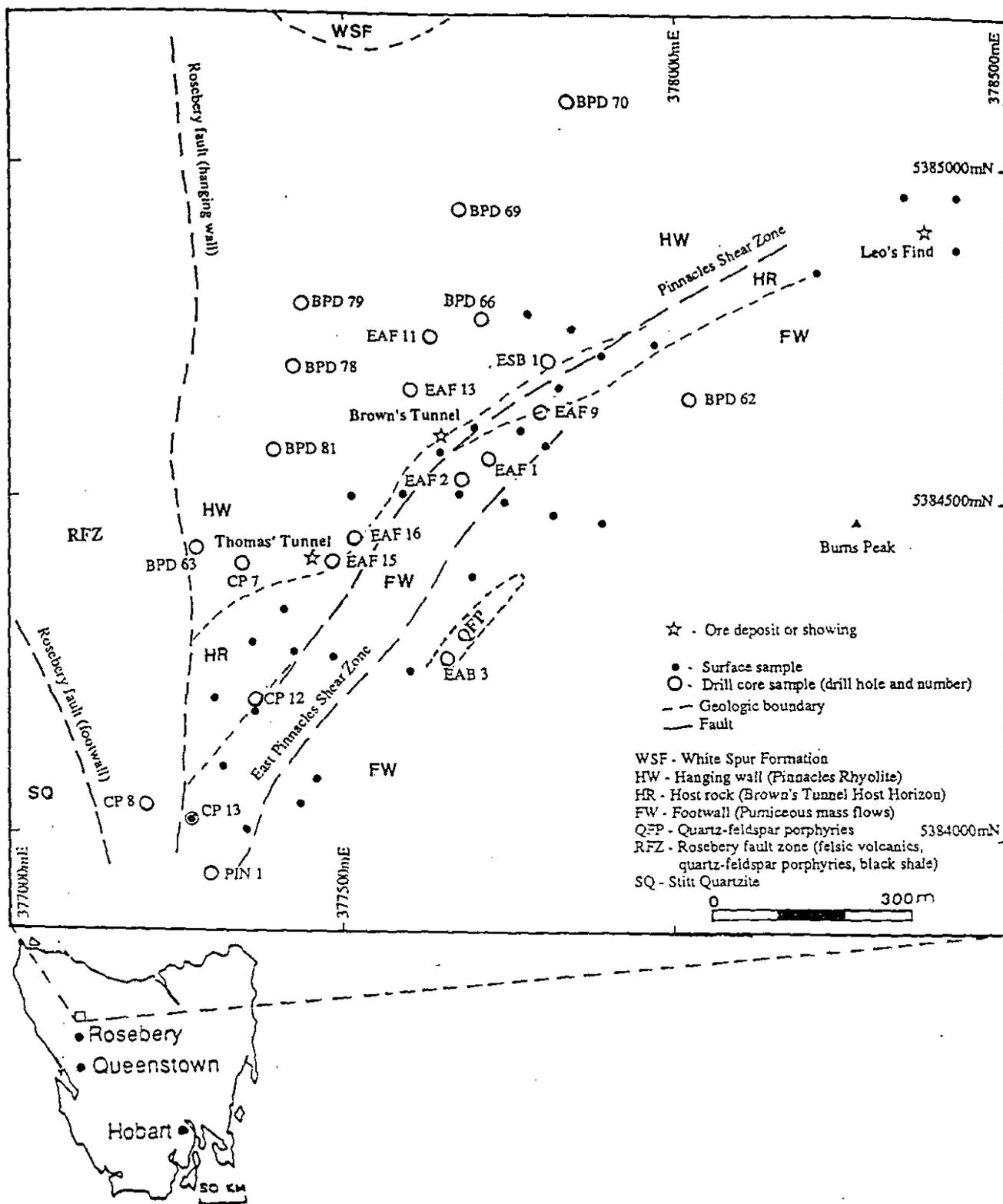
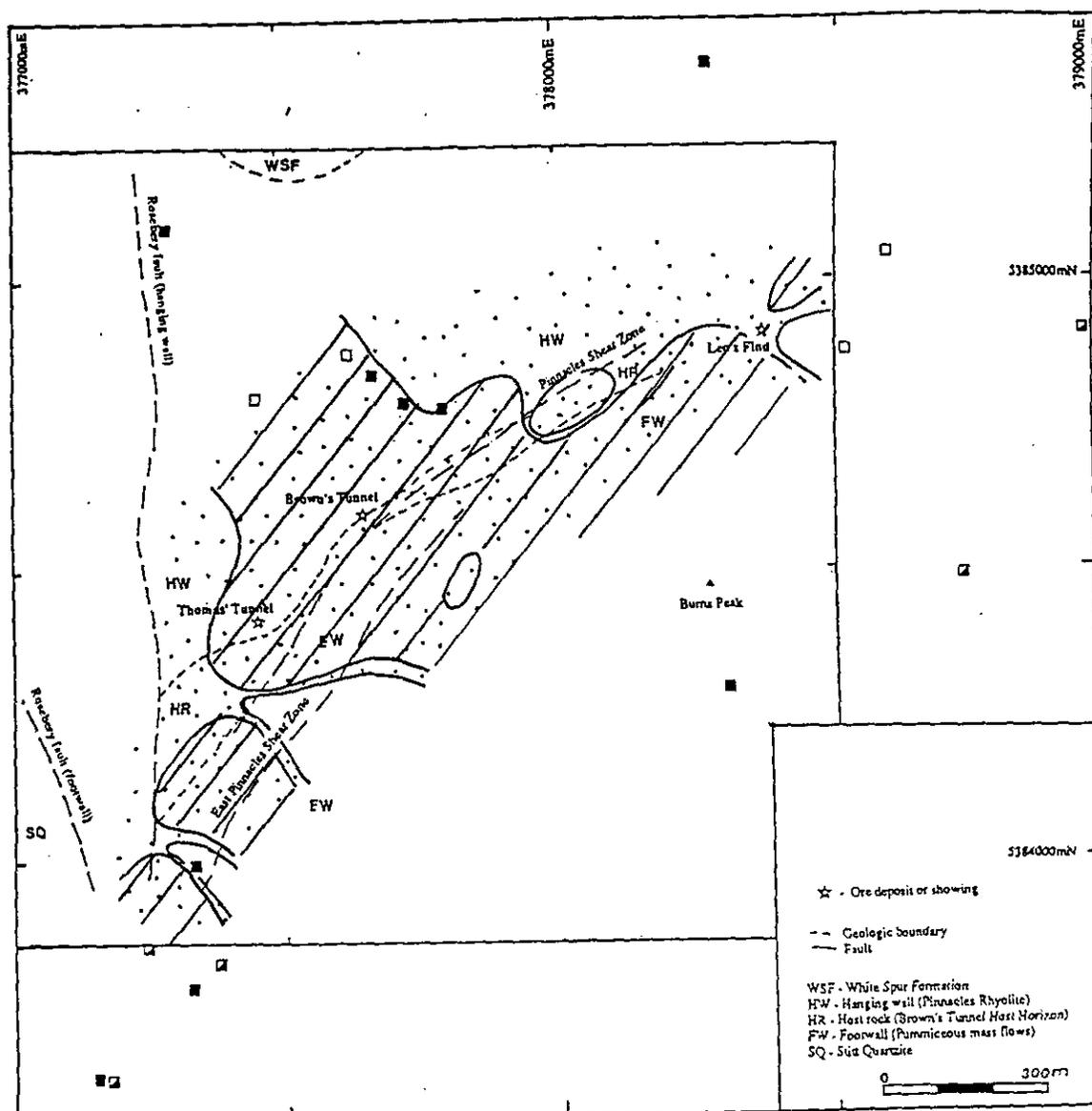
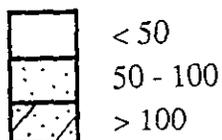


Fig. 2. Locations of previous surface rock and drill core samples (van Moort and Aung Pwa, 1994).



Mn in ppm (1994 study area)



Mn in ppm (in additional samples)

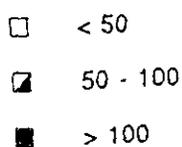
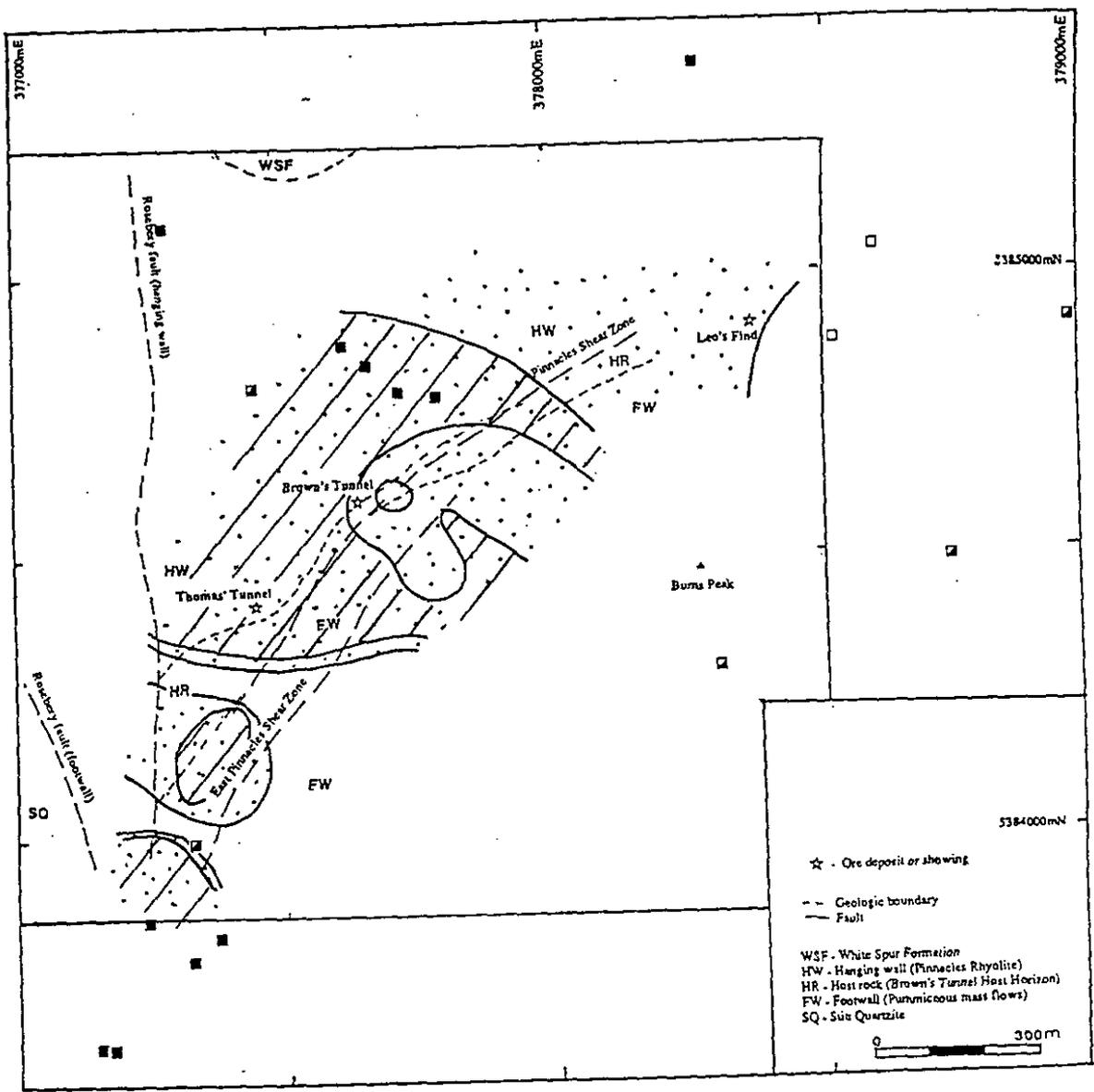
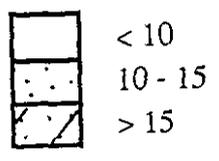


Fig. 3. Distribution of Mn in the rocks in 1994 study area and in additional samples collected in 1995.



Zn in ppm (1994 study area)



Zn in ppm (in additional samples)

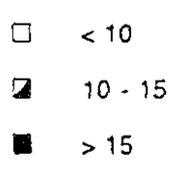
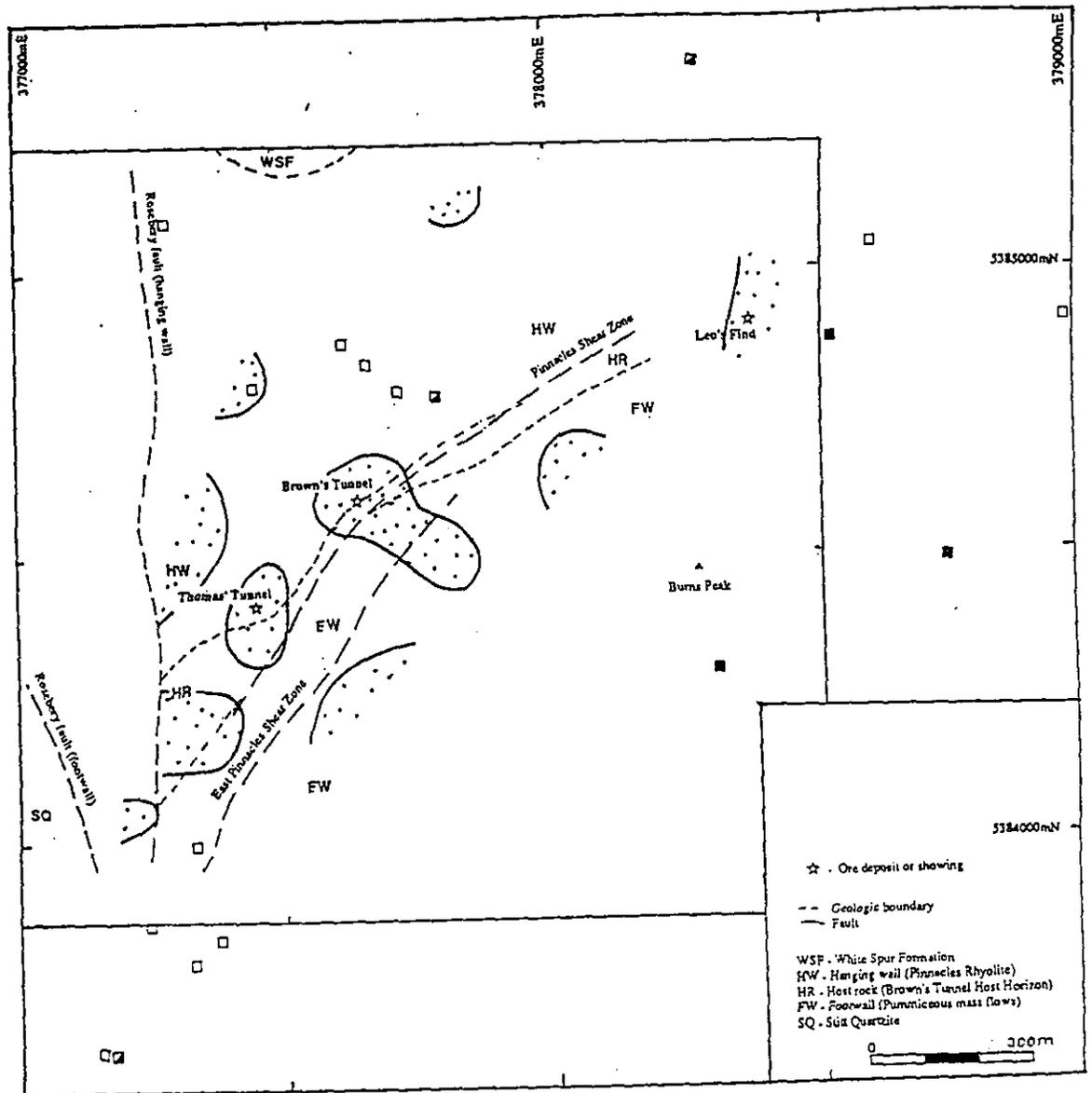


Fig. 4. Distribution of Zn in the rocks in 1994 study area and in additional samples.



Ba in ppm (1994 study area)



Ba in ppm (in additional samples)

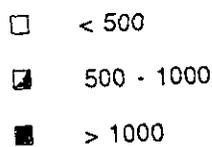


Fig. 5. Distribution of Ba in the rocks in 1994 study area and in additional samples.

Low Ba values of additional samples occur in the low Ba zones of the previous data. The southwestern part of the area has high Mn and Zn values together with low Ba.

There is also a significant positive correlation between the distribution of old and additional data for the following geochemical indices (Figs. 6, 7, 8 and 9).

- (1)  $(K \times Rb)/(Ca \times Na \times Sr)$
- (2)  $(K \times Mn \times Ba \times Rb)/(Ca \times Na \times Sr)$
- (3)  $(Mn \times Ba)/(Ca \times Na \times Sr)$
- (4)  $Zn \times Pb$

High values of these ratios and multiplicative index of additional samples mainly occur within the zones with high ratios and indices of the 1994 report.

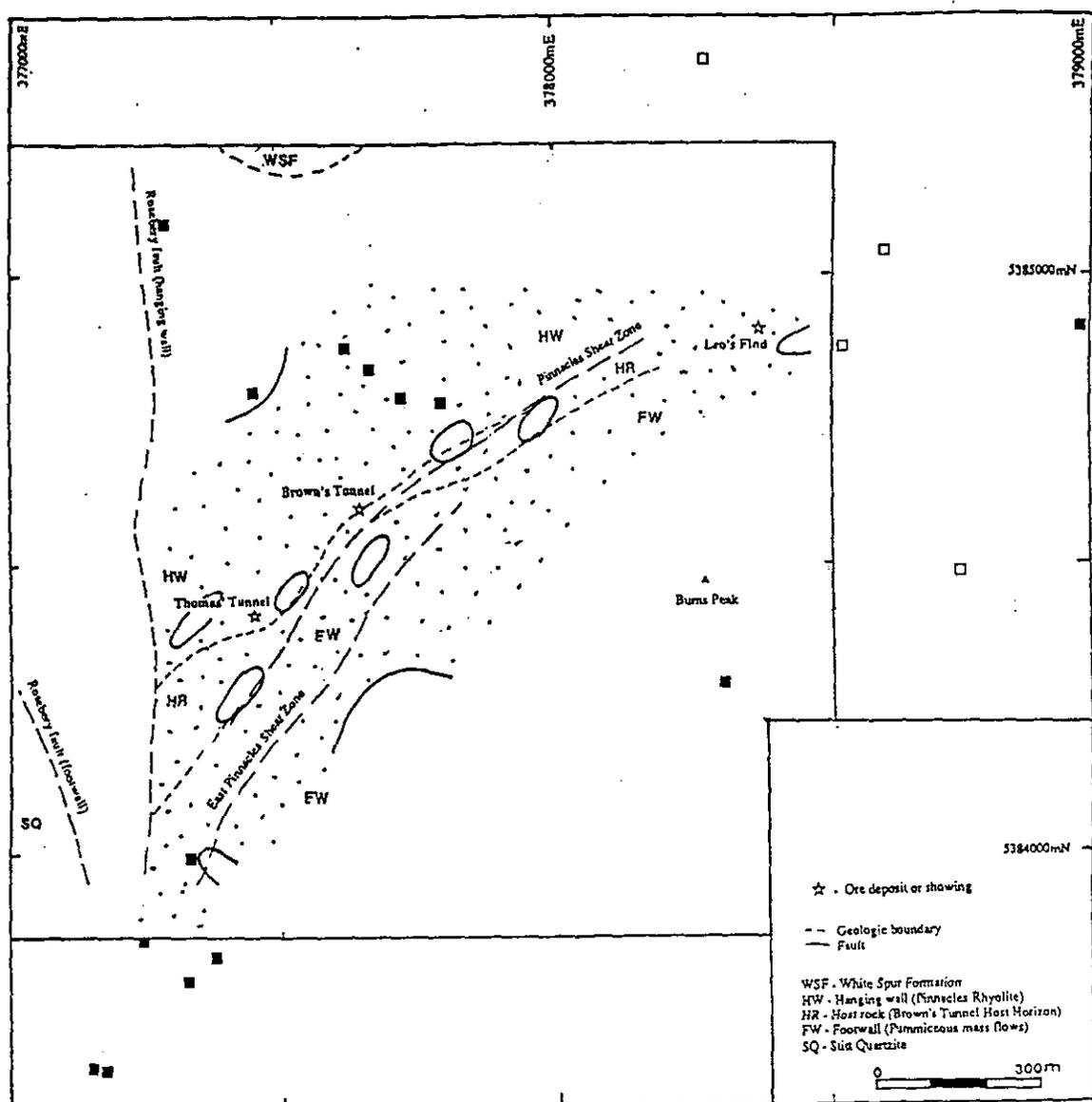
The EPR response particularly EPR intensities measured at magnetic flux density sweeps over  $326.5 \pm 5$  mT and  $\pm 100$  mT also show similarity between previous and additional data (Figs. 10 and 11).

These geochemical and EPR results confirm previously defined geochemical and EPR halos and their trends.

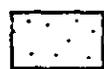
The drill core samples from the eastern area give some interesting geochemical and EPR response particularly in the Burns Peak area. However, the small number of samples in the eastern area cannot define any geochemical and EPR signatures in relation to alteration and mineralisation potential and the present study doesn't intend to investigate the area in any detail.

#### CONSIDERATION ON THE GEOCHEMICAL AND EPR RESPONSE IN THE ROCKS OF THE PINNACLES (BASED ON NEW AND OLD DATA)

In mineral exploration (geological, geochemical, geophysical) it is very important to understand the geology and mineralisation of the study area. In detailed exploration like the Pinnacles project, it is very important to correlate local geology such as lithology, mineralisation, alteration, structure (if available) with the geochemical and geophysical results for a meaningful interpretation. However we have not got enough geological



$(K \times Rb)/(Ca \times Na \times Sr)$  (1994 study area)

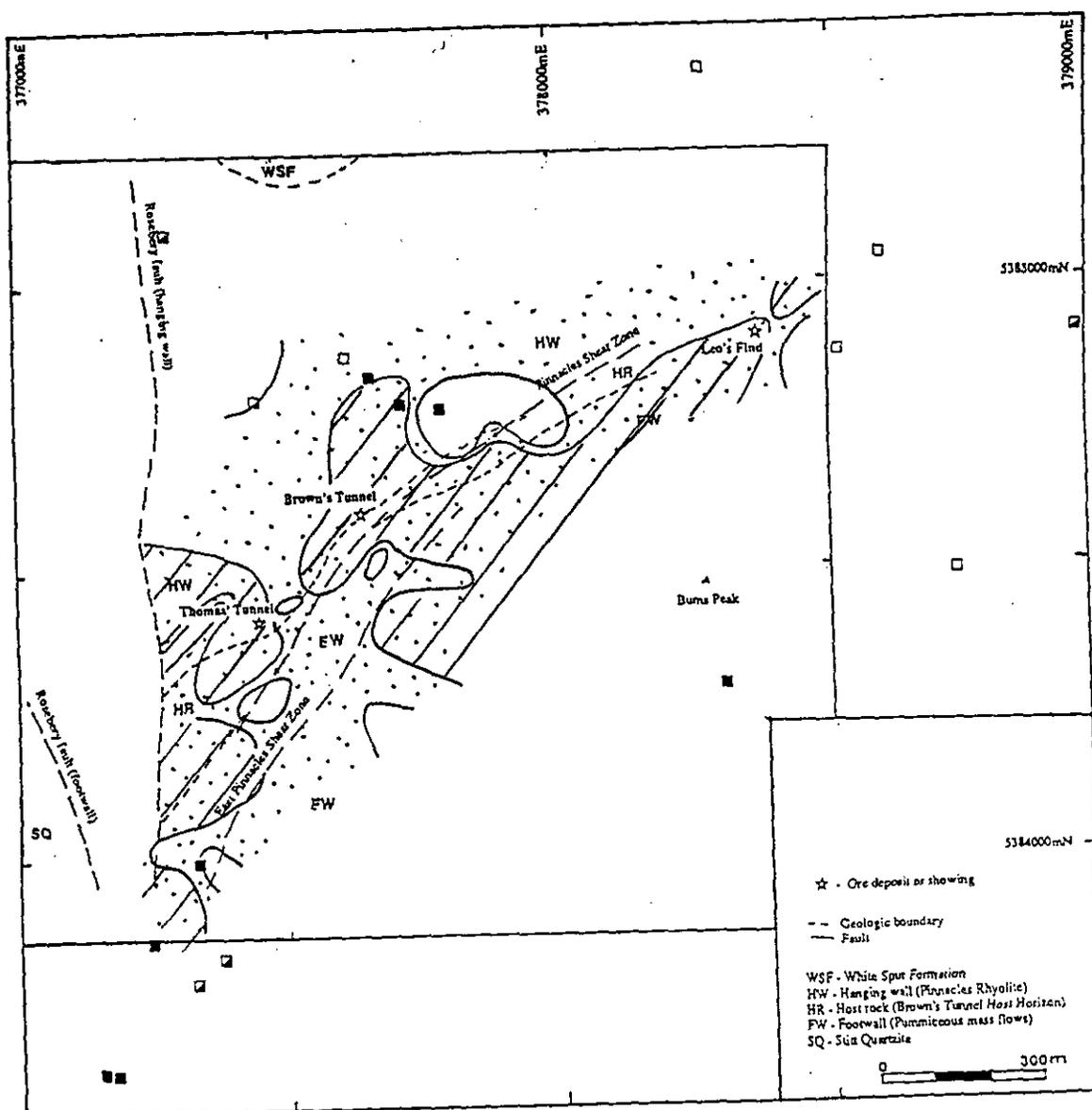
 > 100

$(K \times Rb)/(Ca \times Na \times Sr)$  (in additional samples)

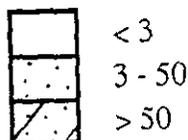
 < 100

 > 100

Fig. 6. Distribution of  $(K \times Rb)/(Ca \times Na \times Sr)$  in the rocks in 1994 study area and in additional samples.



$(K \times Mn \times Ba \times Rb) / (Ca \times Na \times Sr)$  (1994 study area)



$(K \times Mn \times Ba \times Rb) / (Ca \times Na \times Sr)$  (in additional samples)

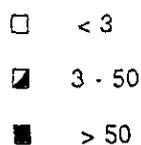
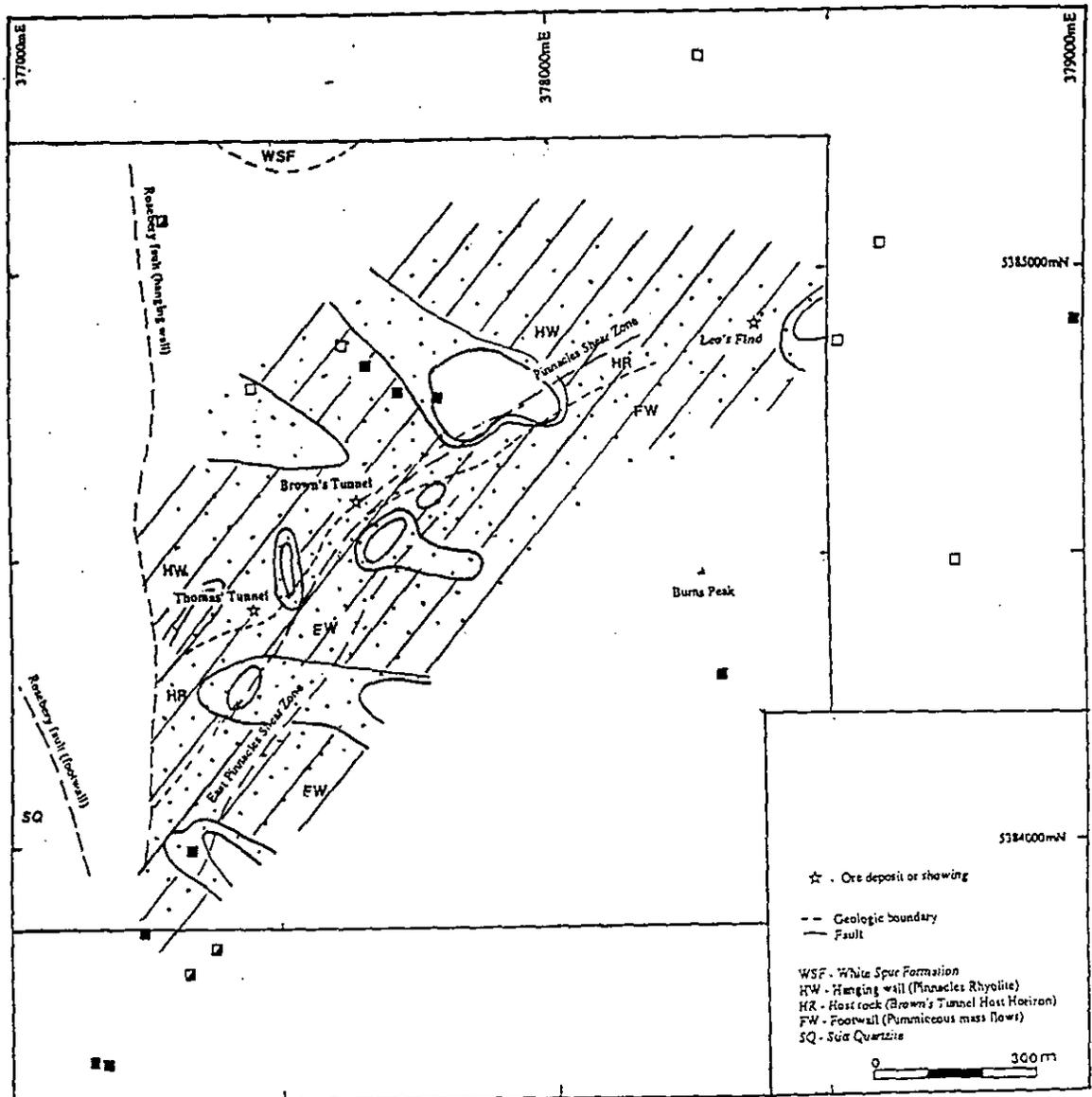
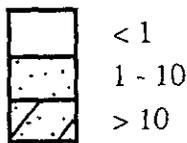


Fig. 7. Distribution of  $(K \times Mn \times Ba \times Rb) / (Ca \times Na \times Sr)$  in the rocks in 1994 study area and in additional samples.



$(Mn \times Ba)/(Ca \times Na \times Sr)$  (1994 study area)



$(Mn \times Ba)/(Ca \times Na \times Sr)$  (in additional samples)

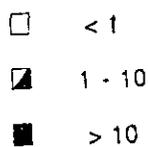
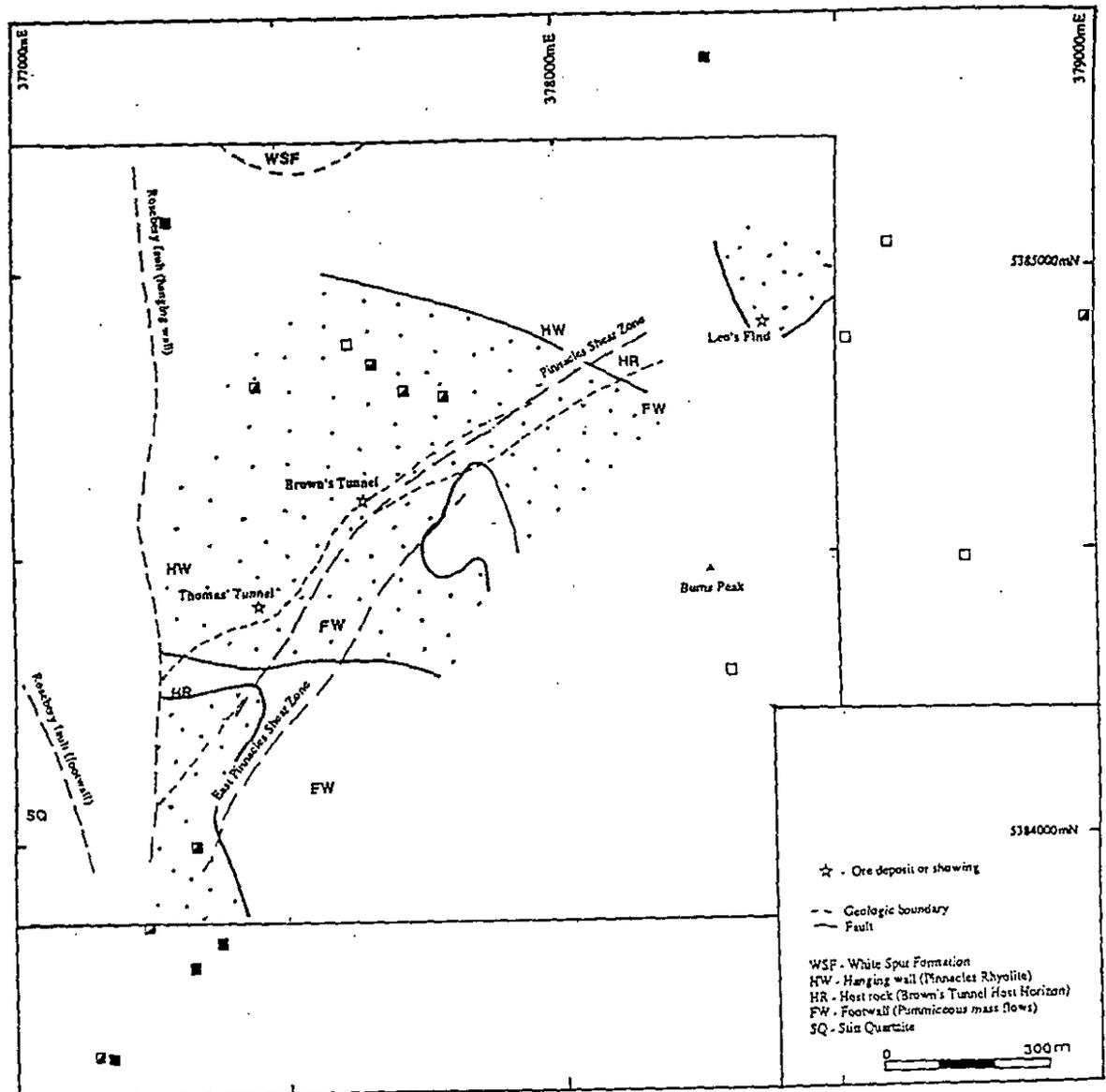


Fig. 8. Distribution of  $(Mn \times Ba)/(Ca \times Na \times Sr)$  in the rocks in 1994 study area and in additional samples.



Zn x Pb (1994 study area)



Zn x Pb (in additional samples)

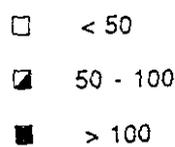
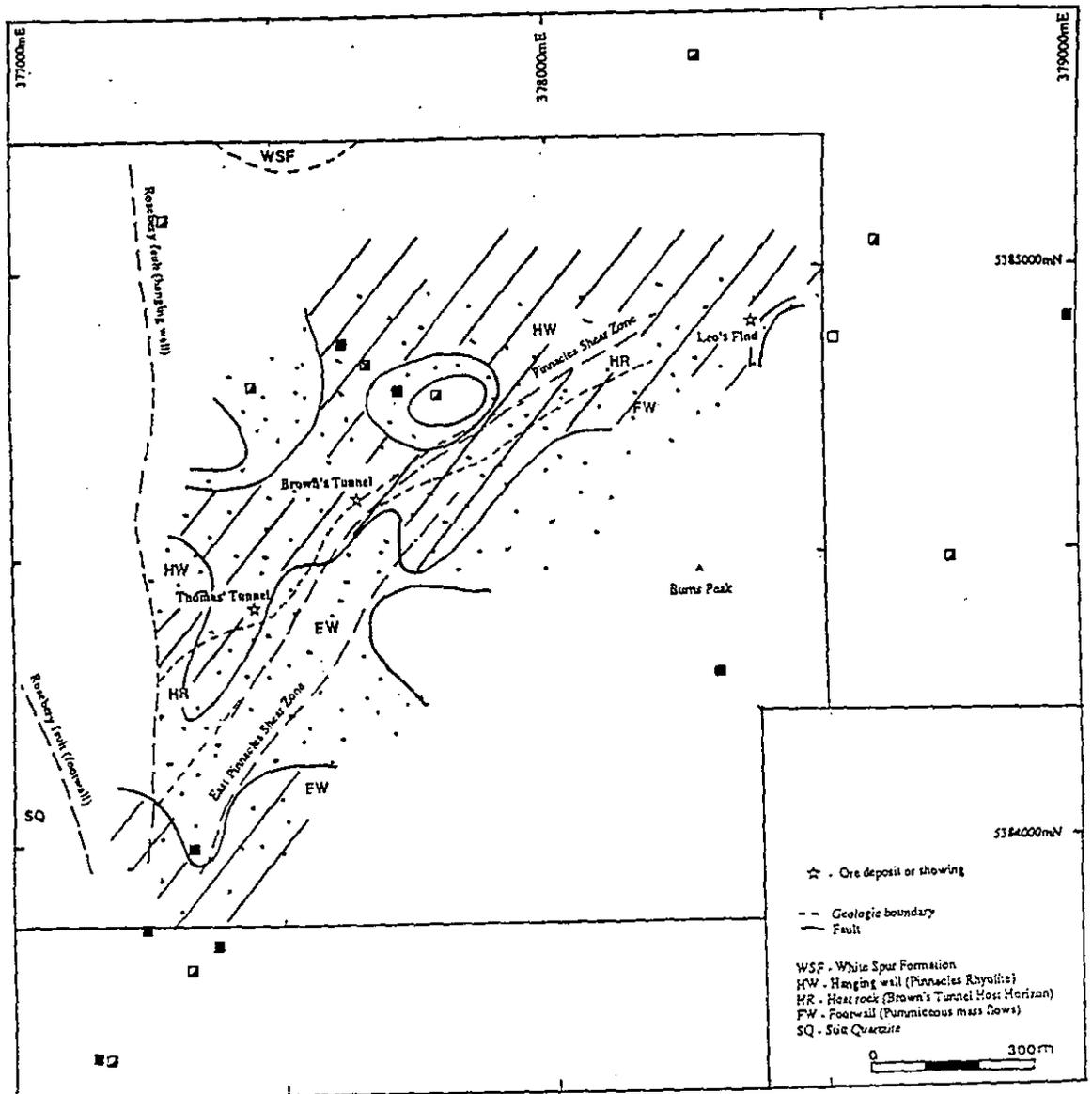
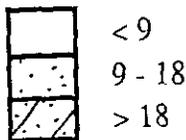


Fig. 9. Distribution of Zn x Pb in the rocks in 1994 study area and in additional samples.



EPR intensity (cm) measured at 326.5±5 mT sweeps (1994 study area)



EPR intensity (cm) measured at 326.5±5 mT sweeps (in additional samples)

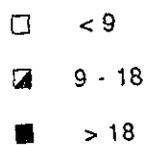
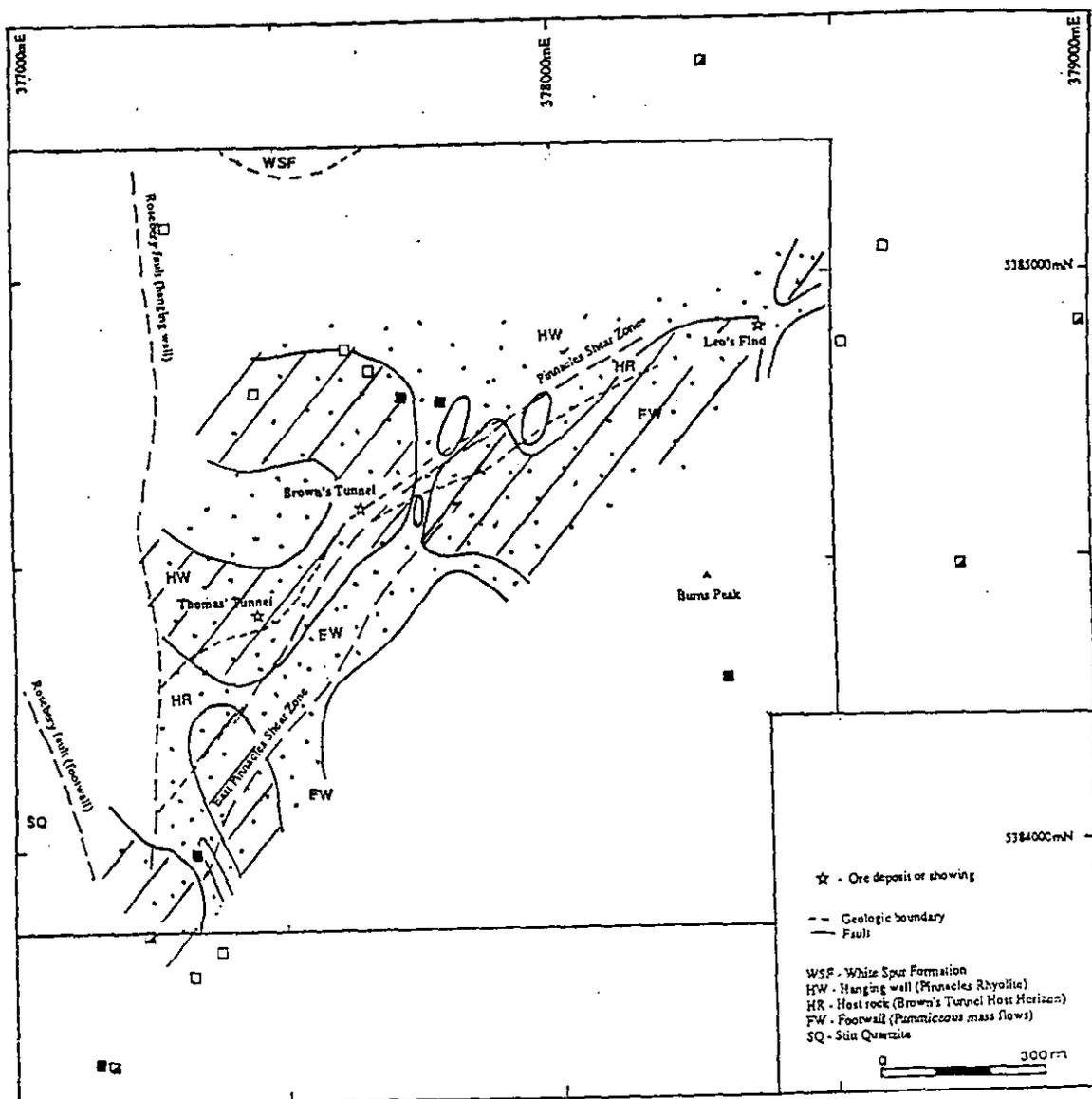
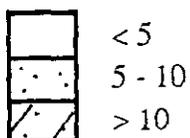


Fig. 10. Distribution of EPR intensity measured at magnetic flux density sweeps over 326.5±5 mT in the rocks in 1994 study area and in additional samples.



EPR intensity (cm) measured at 326.5±100 mT sweeps (1994 study area)



EPR intensity (cm) measured at 326.5±100 mT sweeps (in additional samples)

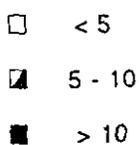


Fig. 11. Distribution of EPR intensity measured at magnetic flux density sweeps over 326.5±100 mT in the rocks in 1994 study area and in additional samples.

information for this Pinnacles project. The interpretation in our reports are consequently based on geochemical and EPR response only.

Re-examination of previous geochemical and EPR data particularly distribution patterns of elements and EPR intensities together with additional data gives the following results. Some of figures were presented in van Moort and Aung Pwa (1994) but not in this report.

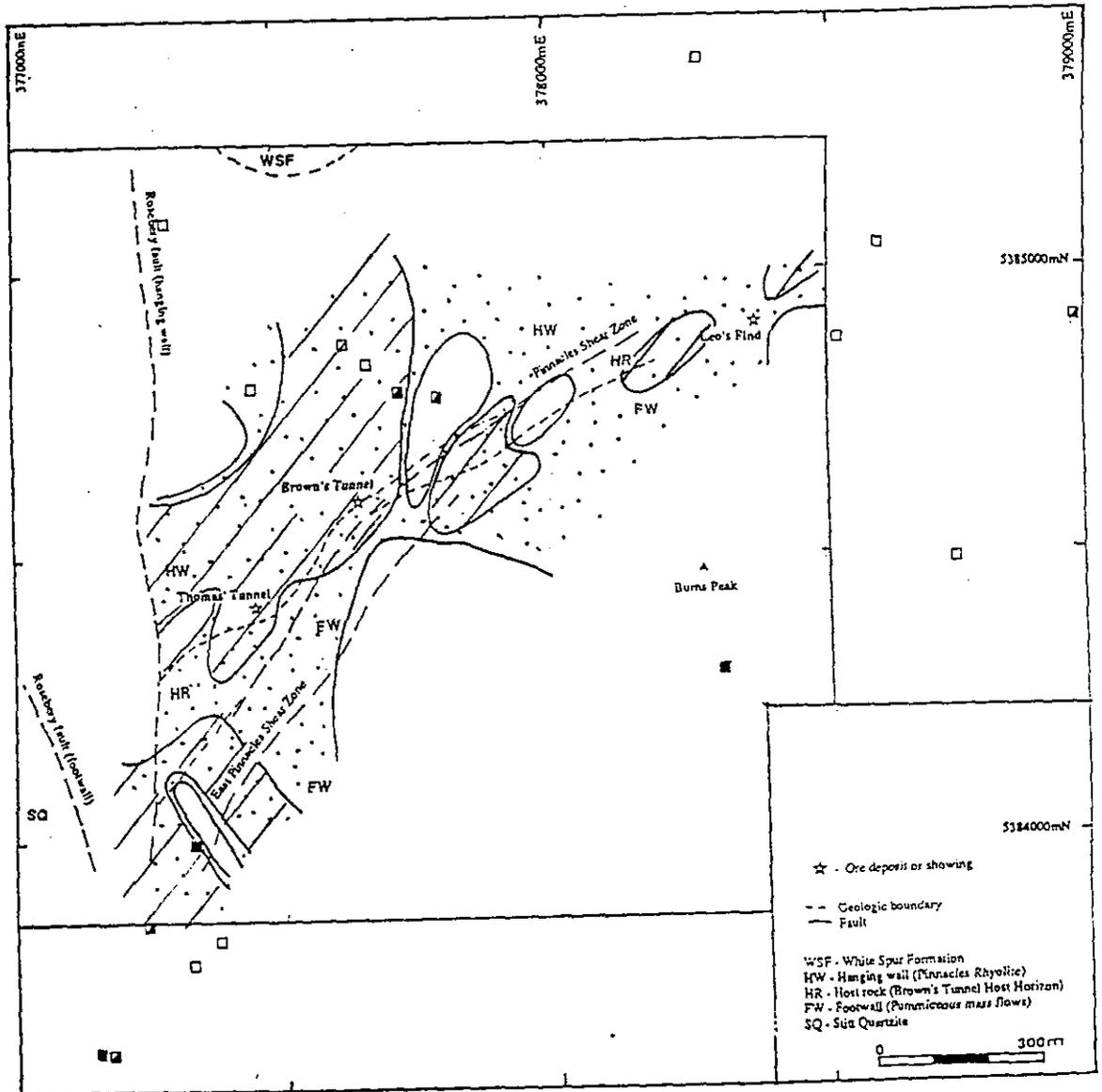
(1) There is a significant EW trending zone of K x Rb (geochemical index of K-Rb in the 1994 report), Mn x Ba, Zn x Pb and Mn x Ba x Zn x Pb in the Pinnacles area. The zone passes through Brown's Tunnel and Thomas' Tunnel, and opens toward Burns Peak area.

(2) The distribution of Mn and Zn also show an EW trend of zones greater than 100 ppm and 15 ppm for Mn and Zn respectively. Both elements forms pronounced anomalous halos associated with known deposits and show high values throughout the area. These two elements are some of the best indicator element for massive sulphide mineralisation in the Rosebery area.

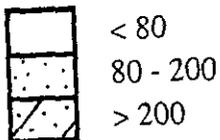
(3) The Ba distribution, although it has significant high values in all the known mineralised areas, does not display a broad halo. However there are several small zones (> 500 ppm Ba) in the area. It should be noted that Ba is the element which normally enrich in the upper level or above the mineralisation system.

The multiplicative ratios of  $(K \times Mn \times Ba \times Rb)/(Ca \times Na \times Sr)$  and  $(Mn \times Ba)/(Ca \times Na \times Sr)$  clearly indicate that the alteration and mineralisation in the Pinnacles area are massive sulphide type. Although Mn and Zn display broad anomalous zones in the study area, high Ba zones are small. Consequently possibility of significant mineralisation (economic deposit) in the Pinnacles area is not clear. The southern part and its extension to the south are interesting in terms of mineralisation potential based on the distribution of Mn, Zn and Pb, and multiplicative ratios of  $(K \times Mn \times Ba \times Rb)/(Ca \times Na \times Sr)$  and  $(Mn \times Ba)/(Ca \times Na \times Sr)$ . There are some moderate to high EPR indices (Fig. 12) in the southwestern part. However significantly low value of Ba may indicate a possibility of limited depth extension of mineralisation (if present).

Information on the variation of Ag, As and Sb, and underground geological data are needed to make a more reliable interpretation of mineralisation potential. Depth extension of known mineralisation and potentiality of hidden mineralisation can be determined by a



EPR index (1994 study area)



EPR index (in additional samples)

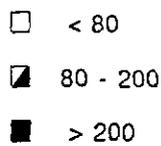


Fig. 12 Distribution of EPR index in the rocks in 1994 study area and in additional samples.

zonality study using geochemical halos of multi-elements (by AAS, NAA and/or XRF analysis).

#### REFERENCES

van Moort, J. C. and Aung Pwa, 1994. Rock Geochemistry and Electron Paramagnetic Resonance (EPR) of the rocks in the Pinnacles area: wall rock alteration and exploration studies. University of Tasmania, unpublished report to Pasminco Exploration, Burnie, August, 1994, 27pp.

APPENDIX

PIXE, PIGME and EPR data of additional sample from Pinnacles area.

Drill core samples

Sample No.	Pasminco No	Drill hole	Depth (m)	K	Fe	Al	Ca	Na	Ti	Mn	Ba	F	Rb	Sr	Cl	Zn	Pb	Cu	Ga	Y	Zr	Nb	V	EPR±5mT (cm)	EPR±100mT (cm)
P55		EAB 2	9	3.46	0.38	6.44	0.03	0.02	0.09	179	1185	1694	146	4	155	11	1	3	15	13	85	14	0	21	13
P56		CP 10	0 - 1	2.99	0.67	5.57	0.03	0.03	0.19	186	411	782	140	3	260	19	3	2	11	21	148	11	39	22	11
P57		CP 15	0 - 1	2.42	0.43	4.66	0.02	0.03	0.13	72	862	517	124	4	136	21	11	2	9	19	129	7	11	17	6
P58		BPD 64	0 - 18	2.14	0.45	4.91	0.02	0.02	0.11	84	81	402	105	2	283	19	16	2	10	19	134	12	34	18	2
P59		BPD 65	8	3.93	0.12	4.57	0.05	1.04	0.12	9	3538	133	76	67	342	6	3	3	6	5	98	6	17	8	1
P60		BPD 71	2.5	2.21	0.34	4.90	0.16	1.92	0.06	101	983	386	94	209	154	17	6	2	9	6	85	6	5	11	6
P61		BPD 72	10	0.63	0.09	3.92	0.04	1.92	0.07	17	86	258	23	54	175	8	5	2	6	10	60	5	18	10	1
P62		BPD 76	13	1.64	0.23	4.81	0.25	1.76	0.12	70	1373	194	64	359	127	10	2	2	7	2	112	4	14	12	6
P63		BPD 77	25	2.00	0.32	5.59	0.02	0.03	0.16	98	306	817	87	5	275	13	7	2	13	11	164	15	23	18	8
P64		EAF 17	9	2.34	0.33	4.52	0.03	0.02	0.14	137	256	819	118	2	253	10	5	2	10	19	250	9	38	23	12
P65		EAF 18	3.6	2.96	0.34	5.33	0.02	0.02	0.17	98	384	966	152	3	297	16	3	3	11	12	184	9	24	21	9
P67		PIN 2	2	2.78	0.54	5.39	0.02	0.03	0.17	119	161	819	162	3	176	28	10	3	11	11	112	9	12	15	4
																							31		

Surface samples

Sample No.	K	Fe	Al	Ca	Na	Ti	Mn	Ba	F	Rb	Sr	Cl	Zn	Pb	Cu	Ga	Y	Zr	Nb	V	EPR±5mT (cm)	EPR±100mT (cm)
P68	3.93	0.53	7.73	0.03	0.02	0.27	117	738	1748	169	2	303	17	3	0	17	28	228	15	45	14	11
P69	1.97	0.51	5.63	0.02	0.01	0.11	146	146	683	80	2	221	35	2	6	14	16	254	14	17	19	8
P70	2.27	0.56	4.60	0.02	0.02	0.07	133	211	751	120	4	269	28	3	2	10	4	71	9	15	17	4
P71	2.88	0.37	5.66	0.03	0.02	0.18	102	101	768	144	4	255	22	8	2	12	14	256	9	33	15	3
P72	2.16	0.33	4.41	0.02	0.02	0.08	40	79	522	96	4	202	35	1	0	9	7	96	10	6	21	1
P73	0.92	0.20	2.94	0.01	0.02	0.27	35	0	317	38	3	179	11	7	8	10	19	199	11	80	16	3