SHORT COMMUNICATION

A CHECK LIST OF MINERALS FROM THE TUI MINE, TE AROHA, NEW ZEALAND

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(*Received 26 March, 1990*)

SUMMARY

Courtney, S.F., King, P. & Rodgers, K.A., (1990). A check list of minerals from the Tui Mine, Te Aroha, New Zealand. *New Zealand Natural Sciences* 17: 95-98.

The lead-copper-zinc ores of Tui Mine, Te Aroha, the former Champion Mine, have been exploited sporadically for over a hundred years. A rich harvest of primary and secondary minerals include 3 native elements, 14 sulphides, selenides and tellurides, 11 oxides and hydroxides, 11 carbonates, 1 phosphate, 1 arsenate, 20 silicates, 15 sulphates, and 1 tungstate, with 6 other probable but ill-defined occurrences.

KEYWORDS: minerals - Tui Mine - New Zealand.

INTRODUCTION

Tui Mine, Te Aroha, New Zealand (lat 37°32′S; long 175°33′E) is one of New Zealand's most prolific mineral localities, with over six dozen species recorded from this one locality. The ore bodies and enclosing host rocks have a long history of scientific documentation (e.g., Park 1893, 1910, Henderson & Bartrum 1913, Cochrane 1969, Weissberg & Wodzicki 1970 Wodzicki and Weissberg, 1970) and have proved a fertile collecting ground for amateur mineralogists whose discoveries have added extensively to the known record.

Ansin (1975) documented some fifty mineral species which had been collected from the workings, both by amateurs and from surveys conducted by Government and Norpac Company scientists in the late 1960s. His list overlooked earlier records (e.g., Park 1893, 1910, Morgan 1927) and did not include information contained in an unpublished thesis manuscript in the University of Auckland Library (Cochrane 1969). This list also took little account of the primary minerals of the host andesites as well as their alteration products. Continued collecting by amateurs in and around the old mine has produced several new records (e.g., Courtney & Rodgers 1990). The following check list has been prepared by combining information from all the above sources. No new records are included, nor are any identifications reported in unpublished manuscripts or files where data is insufficient to verify these. Older records, such as those of Park (1893, 1910) and Morgan (1927), often identify mineral localities only in general terms e.g., Te Aroha. Only where the Champion or Tui Mine is specifically mentioned has a record been included here with the exception of those for electrum, argentite (= ?acanthite) and cerargyrite (= chlorargyrite). No specific records of the occurrence of these minerals at Tui/Champion have been found, but Park (1910), Henderson and Bartrum (1913) and Morgan (1927) imply that all three were encountered in the mine.

The check list has been usefully compared with an unpublished manuscript of Dr W.A. Watters of the New Zealand Geological Survey which updates Morgan's (1927) mineral list for New Zealand as a whole. Watters includes many, but not all, of the minerals reported by Park, Wodzicki, Weissberg, and Ansin

The deposit is a base metal sulphide ore deposit consisting of two lead-copper-zinc lodes, the Ruakaka and Champion veins, which have

developed along structurally simple, fault controlled fissures which cut hydrothermally altered andesitic rocks of 16 m.y. Beesons Island Volcanics (Adams *et al* 1974). Both lodes consist of quartz cemented wall rock breccia, within which is a younger and narrower brecciated zone cemented by chalcopyrite, sphalerite and galena along with pyrite, quartz and minor hematite. Mineralisation occurs along well-defined ore shoots, all ore having a similar mineralogy and paragenesis (Weissberg & Wodzicki 1970, Wodzicki & Weissberg 1970). The hydrothermal alteration is regarded as occurring between 2.6 and 4 million years ago, contemporaneously with Pliocene vulcanism in the region (Adams *et al* 1974).

The listing follows the Dana-style, chemical ordering adopted by Hey (1962) and uses the formulae given by him, except where these have been revised since 1962 as given, for example, by Fleischer (1987).

CHECK LIST

Mineral names in brackets indicate either ill-defined terms, or names of mineral groups rather than of a distinct species. A bracketed letter identifies an ill-defined record but one which may well be correct. + = minerals identified from the least altered host rocks.

MINERAL	M	W	C	A	X
Native elements					
Copper Cu				*	
Gold Au				*	
(Electrum) (Au,Ag)	(P)				
Tellurium Te	*				
Sulfides, selenides, tellurides, etc.					
Chalcocite Cu_2S			*		
Covellite CuS		*	*	*	
Chalcopyrite $CuFeS_2$		*	*	*	*
Argentite = Acanthite Ag_2S	(P)				
Hessite Ag_2Te	*				
Sphalerite ZnS	*	*	*	*	*
(Marmatite) $(Zn,Fe^{++})S$				*	
Greenockite CdS				*	
Hawleyite CdS				*	
Cinnabar HgS	*	*	*	*	
Galena PbS	*	*	*	*	*
Pyrite FeS_2		*	*	*	*
Marcasite FeS_2		*	*	*	
Tennantite $(Cu,Fe)_{12}As_4S_{13}$			*		
Tetrahedrite $(Cu,Fe)_{12}Sb_4S_{13}$		*		*	
Oxides and Hydroxides					
Cuprite Cu_2O				*	
Tenorite = (Melaconite) CuO				*	
+ Quartz SiO_2	*	*	*	*	*
Massicot PbO				*	
Minium $Pb_{2+}{}^{+}Pb^{++++}O_4$				*	
+ Magnetite $Fe^{++}Fe_2^{+++}O_4$		*	*		
Maghemite γ-Fe_2O_3					*
Hematite α-Fe_2O_3				*	*
Goethite α-FeO.OH				*	
Lepidocrocite γ-FeO.OH				*	
(Limonite)				*	*
Halides					
(Cerargyrite) = Chlorargyrite AgCl	(P)				
Carbonates					
Malachite $Cu_2CO_3(OH)_2$				*	
Azurite $Cu_3(CO_3)_2(OH)_2$				*	
Magnesite $MgCO_3$			*		
Calcite $CaCO_3$		*	*	*	
Dolomite $CaMg(CO_3)_2$				*	
Smithsonite $ZnCO_3$				*	
Dundasite $PbAl_2(CO_3)_2(OH)_4.H_2O$				*	
Cerrusite $PbCO_3$	*	*	*	*	
(Ferroan dolomite)				*	
Siderite $Fe^{++}CO_3$			*	*	
Ankerite $Ca(Mg,Fe)(CO_3)_2$				*	
Phosphates, arsenates, etc.					
Pyromorphite $Pb_5(PO_4)_3Cl$	*				
Mimetite $Pb_5(AsO_4)_3Cl$ (*fig.1a*)					*
Silicates, aluminosilicates, etc.					
(Sphene) = Titanite $CaTiSiO_5$		*			
(Leucoxene)		*			
+ (Orthopyroxene)		*	*		
+ Hypersthene $(Mg,Fe^{++})_2Si_2O_6$		*	*		
Allophane (aluminium-silicate gel)				*	
Kaolinite $Al_2Si_2O_5(OH)_4$		*	*	*	*
Halloysite $Al_2Si_2O_5(OH)_4.2H_2O$				*	
Albite $NaAlSi_3O_8$		*	*		
Adularia (K-feldspar) $KAlSi_3O_8$		*	*		

MINERAL (*continued*)	M	W	C	A	X
Illite $K_{2-3}Al_{11}Si_{12-13}O_{35-36}(OH)_{12-13}$		*			
(Sericite)		*	*		
Montmorillonite					
$(Na,Ca)_{0.3}(Al,Mg)_2Si_4O_{10}(OH)_2.nH_2O$		*			
Prehnite $Ca_2Al_2Si_3O_{10}(OH)_2$		*			
Laumontite $CaAl_2Si_4O_{12}.4H_2O$			*		
Leonhardite $CaAl_4Si_8O_{23}.7H_2O$			*		
Wairakite $CaAl_2Si_4O_{12}.2H_2O$		*			
+(Plagioclase) $(NaSi,CaAl)AlSi_2O_8$		*	*		
+Labradorite $(NaSi,CaAl)AlSi_2O_8$		*	*		
+Andesine $(NaSi,CaAl)AlSi_2O_8$		*	*		
+(Chlorite)		*	*		
Epidote $Ca_2(Al,Fe^{+++})_3Si_3O_{12}OH$		*	*		
+(Pyroxene)		*			
+(Clinopyroxene)		*	*		
+Augite $(Ca,Na)(Mg,Fe,Al,Ti)(Si,Al)_2O_6$		*	*		
(Uralite - amphibole)			*		
Sulphates					
Chalcanthite $CuSO_4.5H_2O$				(*)	
Brochantite $Cu_4(SO)_4(OH)_6$ (*Fig. 1b*)					*
Devilline $CaCu_4(SO_4)_2(OH)_6.3H_2O$				*	
Epsomite $MgSO_4.7H_2O$				*	
Gypsum $CaSO_4.H_2O$				*	*
Barite $BaSO_4$	*			*	
Ktenasite (*Fig. 1c*)					
$(Cu,Zn)_5(SO_4)_2(OH)_6.6H_2O$					*
Serpierite $Ca(Cu,Zn)_4(SO_4)_2(OH)_6.3H_2O$				*	
Anglesite $PbSO_4$	*		*	*	
Linarite $(Pb,Cu)_2SO_4(OH)_2$				*	
Beaverite $Pb(Cu,Fe^{+++},Al)_3(SO_4)_2(OH)_6$				*	
Melanterite $Fe^{++}SO_4.7H_2O$				*	
Jarosite $KFe_3^{+++}(SO_4)_2(OH)_6$				*	
Osarizawaite $PbCuAl_2(SO_4)_2(OH)_6$				*	
Posnjakite $Cu_4(SO_4)(OH)_6.H_2O$					*
Tungstates					
Wolframite $(Fe^{++},Mn)WO_4$					*

M = Morgan (1927) including Marshall (1909); P = Park (1893, 1910); Henderson & Bartrum (1913); Morgan & Bartrum (1913); *Annual Reports of the Museum and Colonial Laboratory; Annual Reports of the Colonial Laboratory*; & *Annual Reports of the Dominion Laboratory*.

W = Weissberg & Wodzicki (1970); Wodzicki & Weissberg (1970); and Adams *et al.* (1974).

C = Cochrane (1969).

A = Ansin (1975).

X = Courtney & Rodgers (1990).

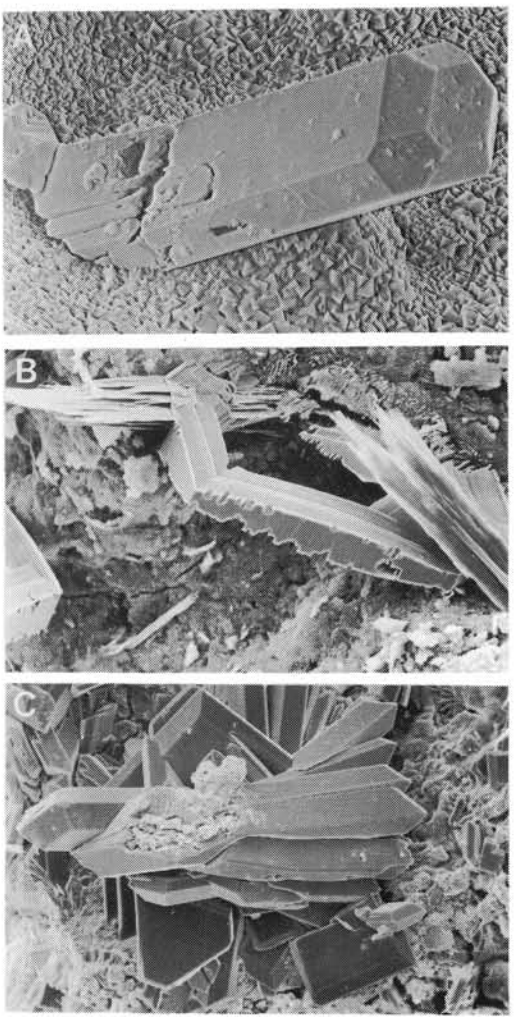

Figure 1. Scanning electron photomicrographs. All scale bars = 0.1 mm. (A) Prismatic mimetite crystal from Tui Mine with well developed $(10\bar{1}1)$, (0001) termination. (B) Twinned brochantite crystal from Tui Mine, showing typical striated habit. The unusual twinning is akin to that seen in pseudohexagonal aragonite. (C) A cluster of ktenasite crystals from Tui Mine. Each crystal consists of a prismatic tablet, flattened on *ac* and terminated by acute hemidomes, clinopinacoids, and hemipyramids.

ACKNOWLEDGMENTS

The manuscript has profited from the advice and counsel of Dr Lin Sutherland of the Australian Museum.

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