Table 2-1-2 Summary of X-Ray Diffraction Analysis (4)

Sample No.	Remarks	Rock Unit	Depth (m)	Clay Minerals								Zeolites				S-Salts			Carbonates			Silicates			Fldsp		Miscellaneous Minerals								
				Mo	Ch	Se	Mu	Ka	Ha	Pr	Mx	Cp	Md	Lm	An	Al	Gy	Ja	Ca	Ak	Si	Cr	Tr	Qz	Pl	Kf	Py	Go	He	Sp	Gn	Ep	Rd	Ho	At
	MJVB-1																																	
101X	White/gray Qz vein	–	10.65																				◎		-?									
103X	White Qz vein	–	28.33		○	△													·	·				◎	·	·								
104X	L-gray Qz vein	–	69.34		·	·													·	○				◎	·	·		·						
105X	White Qz vein/breccia	–	97.48		△	△													△	△				◎	·		·							
106X	White Qz vein/breccia	–	98.62		△	△																		◎	○									
107X	White Qz vein/breccia	–	99.45		△	○																		◎	△		△							
109X	White Qz vein/breccia	–	105.11		△	○																		○	△									
112X	White Qz vein/breccia	–	106.60		○	△													△	·				◎	○	·								
114X	White Qz vein/breccia	–	108.79		△	·																		◎		·								
116X	White Qz vein/veinlet	–	128.93		△	△														△				◎		△	·							
119X	White Qz vein/veinlet	–	137.25		·	·														○				◎		·								
121X	L-gray Qz vein/veinlet	–	154.93		·	△													△	△				◎	△			·						
122X	L-gray Qz vein/veinlet	–	155.46																·	·				◎	-?									
	MJVB-2																																	
202X	L-gray Qz vein	–	77.15		·	△													·	○				◎	·	·								
205X	L-gray Qz vein	–	118.32			·													△	·				◎	·	·								
208X	L-gray Qz vein/network	–	135.20		△	△													△	·				◎	·	·								
209X	White/gray Qz vein/network	–	137.63			·													·	△				◎		-?								
213X	L-gray Qz vein/network	–	148.68			·													○	○				◎		-?								
218X	White/L-gray Qz vein	–	159.30		-?	·													·	△				◎										
220X	Gray Qz veinlet	–	181.27			·													·	○				◎				·						

Abundance of Minerals : ◎;Abundant, ○;Common, △;Few, · ;Rare

Abbreviations : Mo;Montmorillonite, Ch;Chlorite, Se;Sericite, Mu;Muscovite, Ka;Kaolin, Pr;Pyrophyllite, Mx;Mixed-Layer Mineral, Ha;Halloysite, Cp;Clinoptilolite, Md;Mordenite, Lm;Laumontite, An;Analcime, Al;Alunite, Gy;Gypsum, Ja;Jarosite, Ca;Calcite, Ak;Ankerite, Si;Siderite, Cr; α -Cristobalite, Tr;Toridymite, Qz;Quartz, Pl;Plagio -clase, Kf;Potash Feldspar, Py;Pyrite, Go;Goethite, He;Hematite, Sp;Sphalerite, Gn;Galena, Ep;Epidote, Rd;Rhodochrosite, Ho;Hornblende, At;Anatase HW;Hanging Wall, FW;Footwall, Sch;Schist, SS;Sandstone

Table 2-1-2 Summary of X-Ray Diffraction Analysis (5)

Sample No.	Remarks	Rock Unit	Depth (m)	Clay Minerals								Zeolites				S-Salts			Carbonates			Silicates			Fldsp		Miscellaneous Minerals								
				Mo	Ch	Se	Mu	Ka	Ha	Pr	Mx	Cp	Md	Lm	An	Al	Gy	Ja	Ca	Ak	Si	Cr	Tr	Qz	Pl	Kf	Py	Go	He	Sp	Gn	Ep	Rd	Ho	At
	MJVB-3																																	
303X	Silicified/clayey zone	Cmd	71.30		△	△																		◎	・		・?							
306X	White/L-gray Qz-Ca vein	–	80.03		△	△													・					○	・									
311X	White/L-gray Qz vein	–	131.87		△	△																		○	・									
318X	White Qz-Ca vein	–	230.95		△	△													△	・				◎	・									
323X	White Qz vein	–	273.08		△	△													・?	△				○										
	MJVB-4																																	
402X	L-gray Qz-Ca vein	–	40.21		・	・													△	・				○			・							
411X	White Qz-Ca veinlet/network	–	118.75		△	・													○					○										
420X	White Qz-Ca veinlet/network	–	148.59		△	△													△	・				○	・									
426X	Black/white Qz vein	–	193.00		・	△													△	・				○	・		・							
428X	Silicified/clayey zone	Cmd	254.23		・	△													△	・?				○	・									
	MJVB-5																																	
507X	L-gray Qz vein	–	102.05		△	△													・					◎										
509X	L-gray Qz veinlet/network	–	110.59		△	・														△				○	・									
511X	White/L-gray Qz vein/veinlet	–	142.35		△	△																		◎										
518X	White/L-gray Qz veinlet/network	–	203.83		△	・													・	△				◎			・							
521X	L-gray Qz veinlet/network	–	263.43		・	△													○	△				○										
	MJVB-6																																	
602X	L-gray Qz vein	–	4.25			△																		◎	・									
613X	Clayey zone with Qz veinlet	–	35.68			△		・																○	・									
621X	L-gray Qz vein	–	96.48		△	・																		◎			・?							
622X	L-gray Qz veinlet/network	–	108.98		△	△																		○	・			・						
624X	White Qz veinlet	–	168.72			△		・											△					○			・							
626X	White Qz vein/veinlet	–	187.33		△	△													・					○	・		・							

Abundance of Minerals : ◎;Abundant, ○;Common, △;Few, ・;Rare

Abbreviations : Mo;Montmorillonite, Ch;Chlorite, Se;Sericite, Mu;Muscovite, Ka;Kaolin, Pr;Pyrophyllite, Mx;Mixed-Layer Mineral, Ha;Halloysite, Cp;Clinoptilolite, Md;Mordenite, Lm;Laumontite, An;Analcime, Al;Alunite, Gy;Gypsum, Ja;Jarosite, Ca;Calcite, Ak;Ankerite, Si;Siderite, Cr;α -Cristobalite, Tr;Toridymite, Qz;Quartz, Pl;Plagio -clase, Kf;Potash Feldspar, Py;Pyrite, Go;Goethite, He;Hematite, Sp;Sphalerite, Gn;Galena, Ep;Epidote, Rd;Rhodochrosite, Ho;Hornblende, At;Anatase HW;Hanging Wall, FW;Footwall, Sch;Schist, SS;Sandstone

Table 2-1-3 Summary of Ore Microscopy (1)

Sample No.	Locality	Minerals										Remarks
		Py	As	Cp	Sp	Gn	Cv	Au	Tt	Po	Io	
	Regional Area											
A255M	Ba Khe	△	·	·	·	·	·	·		·	·	Qz vein, Au x 1grain, Scorodite found.
A270M	Ba Khe	△		·			·				·	Qz vein
A281M	Lang Hoang			·							·	Gossan, Pyrolusite and Psilomellane found.
B007M	Da Mai	△	·						·	·		Qz float, Energite? found .
B018M	Tan Lap	·			·	○			·			Galena ore, Anglesite & Cerussite found.
B019M	Tan Lap	·			△	○	·		·			Galena ore, Anglesite found.
B024M	S. Tram	·	·	·							·	Qz float, Scorodite found.
B028M	S. Xom	·		·							·	Qz vein, Py disseminated.
C043M	Bai Vang	△		·			·	·		·	·	Qz vein, Au x 5, Scorodite found.
C048M	Bai Vang	△									·	Qz vein
D317M	S. Ngan Me	·		·			·			·		Qz vein
D375M	Khe Hoac	·									·	Qz vein
D376M	Khe Hoac		△									Qz vein, Scorodite found.
D380M	Khe Gang	·								·	·	Qz vein
D387M	Khe Gang											Qz vein
D389M	Khe Gang	△	·	·		·	·			·	·	Qz vein, Bornite found.
D391M	Khe Gang	△								·	·	Qz vein
D392M	Khe Gang	·									·	Qz vein
D398M	Cay Thi	△		·			·			·		Qz vein
D399M	Cay Thi	△		·			·			·	·	Qz vein, Chalcocite found.
D404M	Ngan Me	·								·		Qz vein
D408M	Ngan Me	△		·						·		Qz vein
D419M	Ngan Me	·	·	·	·	·				·		Qz vein
D420M	Ngan Me	·		·		·	·			·		Qz vein
D423M	Ngan Me	·									·	Qz vein
D426M	Ngan Me	△		·			·				·	Qz vein
D444M	Goc Sen	·	○			·		·	·	·	·	Qz vein, Au x 20, Scorodite found.
D448M	Khe Dui	·		△			·				·	Qz vein, Chalcocite found.
D452M	Khe Dui	·									·	Qz vein
D453M	Da Mai	△									·	Qz vein
D455M	Da Mai	·									·	Qz vein

Abundance of Minerals : ○ ; Common, △ ; Rare, · ; Trace

Abbreviations : Py;Pyrite, As;Arsenopyrite, Cp;Chalcopyrite, Sp;Sphalerite, Gn;Galena, Cv;Covelline, Au;Native Gold, Tt;Tetrahedrite-Tennantite, Po;Pyrrhotite, Io;Iron Oxide

Table 2-1-3 Summary of Ore Microscopy (2)

Sample No.	Locality	Minerals										Remarks
		Py	As	Cp	Sp	Gn	Cv	Au	Tt	Po	Io	
	Da Mai Area											
A002P	Da Luon	△		·	·	·				·	·	Qz vein (L-gray)
A003P	Da Luon			·						·		Black Schist (Cmd), Graphite trace
A005P	Da Luon	△									·	Qz vein
A009P	Dat Dau	·									·	Qz vein
A016P	Gac Ba										·	Qz vein
A019P	Khe Thuon	·									△	Qz vein
A041P	Lang Vang										·	Qz vein
A043P	Lang Vang	·									·	Qz vein (White)
A096P	Khe Cuc Tac	△									·	Qz vein (L-gray)
A111P	Da Trang	△		·							·	Qz vein (White)
A248P	Khe Dui		·								·	Qz vein (White/L-gray), visible Au.
A264P	Khe Dui	△		·				△			·	Qz vein (White/L-gray), visible Au. Gold grains (0.01 to 0.3 mm) occur as free gold and are contained in arsenopyrite.
B001P	Khe Dui	·		·						·	·	Qz vein (White)
B010P	Khe Dui	△		·	·							Qz vein (White/L-gray), Ca associated
B011P	Khe Dui										·	Qz vein (White)
B012P	Khe Dui	·									·	Qz vein (White)
B013P	Khe Dui	·									·	Qz vein
B015P	Khe Dui	△	·	·	·							Qz vein (White/L-gray)
B017P	Khe Dui	·		·			·				·	Qz vein (White/L-gray)
B047P	Ngoc An	·									·	Qz vein (L-gray)
	Ngan Me Area											
A124P	S. Ho Mai	△	·	·			·			·	·	Qz vein (White)
A139P	S. Ngan Me	·		·							·	Qz vein (White/L-gray)
A148P	S. Na Hon	·									·	Qz vein (White/L-gray)
A150P	S. Na Hon	△		·	·	·				·		Qz vein (White)
A151P	S. Na Hon	·									△	Qz vein (L-gray), Magnetite, Hematite associated.
A165P	Khe Chuoi	·	·								·	Qz vein (L-gray)
A166P	Khe Chuoi	·									·	Qz vein (L-gray)
B096P	Ba Khe	·		·						·	·	Qz vein (White/L-gray)
B104P	Ba Khe	△		·							·	Qz vein (White/L-gray), Py disseminated.
B127P	Ba Khe	○	△	·		·	·			·	·	Qz vein (White/L-gray), Py disseminated.
B133P	Khe Dong	△	·	·		·	·			·	·	Qz vein (White/L-gray)
B137P	Khe Dong	△		·	·		·			·	·	Qz vein (White)
B150P	Khe Goc Tro	○	△	·	·	·					·	Qz network (White/L-gray)

Abbreviations : Py;Pyrite, As;Arsenopyrite, Cp;Chalcopyrite, Sp;Sphalerite, Gn;Galena, Cv;Covelline, Au;Native Gold, Tt;Tetrahedrite-Tennantite, Po;Pyrrhotite, Io;Iron Oxide

Table 2-1-3 Summary of Ore Microscopy (3)

Sample No.	Depth	Minerals										Remarks
		Py	As	Cp	Sp	Gn	Cv	Au	Tt	Po	Io	
	MJVB-1											
104P	69.34 m	△	·	·								Qz vein (L-gray), Py diss.
105P	97.47 m	△	·	·								Qz vein/breccia (White), Py diss.
110P	105.70 m	·		·	·	·						Qz vein/breccia (White), Py diss. Anglesite was found.
113P	108.00 m	·	·	·		·						Qz vein/breccia (White), Py diss, visible Au.
115P	110.55 m	·	·	·	·					·		Qz vein/breccia (White/gray), Py diss.
118P	136.75 m	△		·	·							Qz vein/veinlet (White), visible Au.
121P	154.93 m	·										Qz vein/veinlet (L-gray), Py diss, visible Au. Magnetite was found.
	MJVB-2											
205P	118.32 m	·										Qz vein (L-gray), Py diss.
208P	135.20 m	·	·	·						·		Qz vein (L-gray), Py,As diss.
213P	148.68 m	·		·						·		Qz vein/network (L-gray), Py,As diss, visible Au.
220P	181.27 m	·		·				·				Qz veinlet (Gray), Py diss, visible Au. A grain of native gold (0.5 mm) was observed.
224P	207.83 m	·	·	△						·		Qz vein (White/gray), Py,As,Cp diss.
	MJVB-3											
301P	31.63 m	·									·	Qz veinlet (White/L-gray).
306P	80.03 m	·									·	Qz-Cal vein (White/L-gray), Py & Limo diss. Visible Au
313P	147.77 m	△	·	·	·	·				·		Qz-Cal network (L-gray), Py diss.
318P	230.96 m	△	·									Qz-Cal vein (White), Py & As diss.
322P	253.68 m	△	·	·	·							Qz vein/network (White/L-gray), Py & As diss.
	MJVB-4											
402P	40.21 m	△	·	·	·	·				·		Qz-Cal vein (L-gray), Py diss.
408P	106.05 m	·	·	·	·	·				·		Qz-Cal vein (White), Py& Sp diss.
409P	115.56 m	·	·	·						·		Qz-Cal veinlet/network (White), Py & As diss.
413P	131.88 m	·	·	·	·					·		Qz-Cal veinlet/network (White), Py & As diss.
418P	146.33 m	△	·	·		·				△		Qz-Cal veinlet/network (White), Py & As diss.
426P	193.00 m	·		·	·	·				·		Qz vein (Black/White), Py diss.
	MJVB-5											
501P	26.93 m	·									·	Qz vein (L-gray), Limo diss.
504P	65.57 m	△		·			·			·	·	Qz vein (White), Limo diss.
511P	142.35 m	·		·								Qz vein/veinlet (White/L-gray), Py diss.
518P	203.83 m	△		·	·	·				·		Qz veinlet/network (White/L-gray), Py diss.
	MJVB-6											
603P	4.68 m	·									△	Qz vein/silicified zone (L-gray), Py & Limo diss.
614P	36.45 m	△									·	Qz vein (L-gray), Py diss.
621P	96.48 m	·		·							·	Qz vein (L-gray), Py diss.
624P	168.72 m	△	·	·	·	·				·		Qz veinlet (White), Py diss.
626P	187.33 m	△		·		·				·		Qz vein/veinlet (White), Py,Gn & Cp diss.

Abbreviations : Py;Pyrite, As;Arsenopyrite, Cp;Chalcopyrite, Sp;Sphalerite, Gn;Galena, Cv;Covelline, Au;Native Gold, Tt;Tetrahedrite-Tennantite, Po;Pyrrhotite, Io;Iron Oxide, Limo;Limonite.

Table 2-1-4 Assay Results of Ore Samples (First Phase) (1)

Sample No.	Width (cm)	Au (g/t)	Ag (g/t)	Cu (%)	Pb (%)	Zn (%)	As (%)	Sb (%)	Hg (ppm)	Locality
A217A	20	0.06	<0.2	0.01	0.02	0.01	0.09	<0.01	<0.03	Khe Hoac
A218A	float	1.41	<0.2	0.01	0.03	0.01	0.08	<0.01	0.04	Khe Hoac
A255A	12	0.42	1.4	0.01	0.02	<0.01	0.33	<0.01	0.04	Ba Khe
A257A	30	0.04	<0.2	<0.01	<0.01	0.01	<0.01	<0.01	<0.03	Middle Ba Khe
A258A	20	0.11	<0.2	<0.01	<0.01	0.01	<0.01	<0.01	<0.03	Middle Ba Khe
A262A	23	0.03	0.3	<0.01	<0.01	<0.01	0.01	<0.01	<0.03	Middle Ba Khe
A263A	40	0.02	0.8	<0.01	<0.01	<0.01	0.01	<0.01	<0.03	Middle Ba Khe
A269A	20	0.14	1.0	0.01	0.02	<0.01	0.02	<0.01	<0.03	Left Ba Khe
A270A	150	0.19	3.8	0.05	0.07	<0.01	0.05	<0.01	<0.03	Left Ba Khe
A281A	grab	0.13	12.6	<0.01	1.93	0.10	0.11	0.01	<0.03	Lang Hoan
A282A	grab	0.09	11.7	<0.01	0.34	0.13	<0.01	<0.01	0.11	Lang Hoan
B001A	float	0.01	0.8	<0.01	0.32	0.01	<0.01	<0.01	0.07	Da Mai
B002A	10	0.02	0.4	0.03	<0.01	0.01	0.01	<0.01	<0.03	Da Mai
B003A	5	0.02	0.8	0.01	0.46	0.01	0.01	<0.01	<0.03	Da Mai
B004A	float	0.05	1.0	<0.01	0.01	<0.01	<0.01	<0.01	<0.03	Da Mai
B005A	10	0.01	0.3	<0.01	0.01	0.01	<0.01	<0.01	<0.03	Da Mai
B007A	float	0.38	2.0	0.48	0.01	<0.01	0.05	0.01	<0.03	Da Mai
B008A	15	0.01	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.03	Da Mai
B009A	5	0.01	1.2	<0.01	0.01	<0.01	<0.01	<0.01	<0.03	Da Mai
B010A	10	0.02	1.3	<0.01	0.05	0.01	<0.01	<0.01	<0.03	Da Mai
B011A	13	0.04	0.6	<0.01	0.02	<0.01	<0.01	<0.01	<0.03	Da Mai
B012A	float	0.04	5.7	<0.01	0.43	0.09	0.04	<0.01	<0.03	Da Mai
B013A	float	0.01	15.3	<0.01	0.24	0.18	0.02	<0.01	<0.03	Da Mai
B014A	7	0.01	1.2	<0.01	0.35	0.01	<0.01	<0.01	<0.03	Doc Trung
B016A	6	0.01	1.4	<0.01	0.26	0.01	<0.01	<0.01	0.03	Nui Sue Cat
B017A	7	0.01	1.7	<0.01	0.01	<0.01	<0.01	<0.01	<0.03	Nui Sue Cat
B018A	float	0.01	282.3	0.07	10.36	1.09	0.03	0.04	2.71	Tan Lap Mine
B019A	float	0.01	178.3	0.10	9.84	6.88	0.04	0.07	7.40	Tan Lap Mine
B020A	5	0.01	1.8	<0.01	0.01	<0.01	<0.01	<0.01	<0.03	Lung Than
B021A	5	0.01	<0.2	0.01	<0.01	0.01	0.01	<0.01	<0.03	Lung Than
B022A	60	0.02	0.3	0.01	<0.01	0.01	<0.01	<0.01	<0.03	S. Tram
B023A	12	0.02	3.3	<0.01	0.05	0.01	0.03	<0.01	<0.03	S. Tram
B024A	float	0.91	19.0	<0.01	<0.01	<0.01	0.57	0.04	<0.03	S. Tram
B025A	70	0.03	<0.2	0.01	0.36	0.06	<0.01	<0.01	0.07	S. Tram
B026A	7	0.03	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.03	S. Xom Nac
B027A	5	0.09	0.2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.03	S. Xom Nac
B028A	30	0.06	207.1	0.01	0.03	<0.01	0.01	<0.01	<0.03	S. Xom
B029A	float	0.64	2.0	0.02	0.04	0.01	0.60	<0.01	<0.03	S. Bo Da
B030A	3	0.01	<0.2	<0.01	<0.01	0.02	0.01	<0.01	<0.03	S. Bo Da
C031A	50	0.01	73.1	0.01	8.85	0.06	0.04	0.01	0.13	Tan Lap Mine
C032A	120	0.01	99.6	0.01	9.33	0.39	0.04	0.01	0.26	Tan Lap Mine
C033A	70	<0.01	162.9	0.01	5.83	0.07	0.03	<0.01	0.54	Tan Lap Mine
C043A	200	0.50	1.4	0.01	0.10	<0.01	0.02	<0.01	<0.03	Khe Rua
C048A	20	0.01	<0.2	0.01	0.09	<0.01	0.01	<0.01	<0.03	Khe Cam
C049A	200	0.02	<0.2	<0.01	0.05	<0.01	<0.01	<0.01	<0.03	Khe Dinh
C053A	200	0.01	<0.2	<0.01	0.06	<0.01	0.01	<0.01	<0.03	S. Nhoan
D312A	float	<0.01	<0.2	<0.01	0.00	<0.01	0.01	<0.01	<0.03	S. Ngan Me
D323A	float	0.02	4.2	<0.01	0.37	0.08	<0.01	<0.01	<0.03	S. Ngan Me
D367A	float	0.01	<0.2	<0.01	0.02	<0.01	<0.01	<0.01	<0.03	S. Hoan
D371A	30	0.50	<0.2	0.03	0.13	0.01	0.12	0.01	<0.03	Khe Hoac
D372A	35	0.05	<0.2	0.01	0.04	<0.01	0.04	<0.01	<0.03	Khe Hoac
D373A	55	0.14	<0.2	0.01	0.02	<0.01	0.03	<0.01	<0.03	Khe Hoac
D374A	45	0.07	<0.2	0.02	0.03	0.01	0.03	<0.01	<0.03	Khe Hoac
D377A	13	0.40	0.6	0.01	0.01	<0.01	0.10	<0.01	0.05	Khe Hoac
D378A	40	0.69	0.5	0.01	<0.01	<0.01	0.02	<0.01	0.06	Khe Hoac
D379A	70	0.04	1.7	0.01	0.04	0.01	0.01	<0.01	0.04	Khe Gang
D381A	25	0.12	0.5	0.01	<0.01	<0.01	0.01	<0.01	0.04	Khe Gang
D382A	40	0.20	1.1	0.01	0.01	0.01	0.01	<0.01	0.04	Khe Gang
D383A	26	0.02	<0.2	0.01	0.01	<0.01	<0.01	<0.01	0.04	Khe Gang
D384A	45	0.03	<0.2	0.01	<0.01	<0.01	<0.01	<0.01	<0.03	Khe Gang
D385A	13	0.02	0.3	0.01	0.02	<0.01	<0.01	<0.01	0.03	Khe Gang
D386A	40	0.02	1.0	0.01	<0.01	<0.01	<0.01	<0.01	<0.03	Khe Gang
D388A	40	0.01	<0.2	0.01	<0.01	0.01	0.01	<0.01	<0.03	Khe Gang
D389A	36	0.01	0.6	0.01	<0.01	<0.01	0.01	<0.01	<0.03	Khe Gang
D390A	40	0.03	0.4	<0.01	<0.01	<0.01	0.04	<0.01	<0.03	Khe Gang
D393A	10	20.23	1.0	0.01	0.01	0.01	0.02	<0.01	<0.03	Cay Thi
D394A	15	1.50	0.5	0.01	0.01	0.01	0.02	<0.01	<0.03	Cay Thi
D397A	grab	0.52	0.7	0.01	<0.01	<0.01	0.06	<0.01	<0.03	Cay Thi
D398A	grab	1.00	1.4	<0.01	0.01	<0.01	0.01	<0.01	<0.03	Cay Thi

Table 2-1-4 Assay Results of Ore Samples (First Phase) (2)

Sample No.	Width (cm)	Au (g/t)	Ag (g/t)	Cu (%)	Pb (%)	Zn (%)	As (%)	Sb (%)	Hg (ppm)	Locality
D399A	grab	0.02	0.3	0.01	<0.01	<0.01	<0.01	<0.01	<0.03	Cay Thi
D400A	5	0.05	0.3	0.01	0.01	<0.01	0.02	<0.01	<0.03	Ngan Me
D402A	4	0.19	0.2	0.01	0.07	0.01	0.10	<0.01	<0.03	Ngan Me
D403A	5	0.12	<0.2	0.01	0.15	0.01	0.10	<0.01	<0.03	Ngan Me
D405A	60	0.05	0.5	0.01	0.01	0.01	0.01	<0.01	<0.03	Ngan Me
D406A	18	0.02	1.8	0.01	<0.01	<0.01	0.01	<0.01	<0.03	Ngan Me
D407A	20	1.89	0.2	0.01	<0.01	<0.01	0.43	<0.01	<0.03	Ngan Me
D409A	21	0.05	0.2	0.01	0.01	<0.01	0.01	<0.01	<0.03	Ngan Me
D410A	5	5.49	1.1	0.01	0.03	0.01	0.04	<0.01	<0.03	Ngan Me
D411A	2	1.00	<0.2	<0.01	<0.01	<0.01	0.01	<0.01	<0.03	Ngan Me
D412A	10	0.01	0.4	<0.01	<0.01	<0.01	<0.01	<0.01	<0.03	Ngan Me
D413A	10	0.02	0.2	0.01	<0.01	<0.01	0.01	<0.01	<0.03	Ngan Me
D414A	3	0.44	0.2	0.01	0.01	<0.01	0.08	<0.01	<0.03	Ngan Me
D415A	15	0.14	0.4	0.01	0.03	0.01	0.06	<0.01	<0.03	Ngan Me
D416A	15	0.17	0.2	0.01	<0.01	0.01	0.20	<0.01	<0.03	Ngan Me
D417A	7	1.42	1.6	<0.01	0.04	<0.01	0.28	<0.01	<0.03	Ngan Me
D418A	15	0.34	0.2	0.01	0.06	0.01	0.06	<0.01	<0.03	Ngan Me
D423A	5	0.03	0.2	0.01	0.01	<0.01	0.01	<0.01	<0.03	Ngan Me
D426A	12	0.01	0.3	0.01	<0.01	<0.01	0.02	<0.01	<0.03	Ngan Me
D444A	grab	0.04	0.6	<0.01	<0.01	<0.01	0.03	<0.01	<0.03	Goc Sen
D445A	20	2.00	<0.2	0.06	0.01	<0.01	0.12	<0.01	<0.03	Khe Dui
D446A	15	0.11	<0.2	0.05	0.01	<0.01	0.06	<0.01	<0.03	Khe Dui
D447A	15	0.51	<0.2	0.08	0.01	<0.01	0.13	<0.01	<0.03	Khe Dui
D449A	40	0.60	1.5	0.02	<0.01	0.01	0.24	0.01	0.03	Khe Dui
D450A	40	1.05	1.8	0.01	0.01	0.01	0.21	<0.01	0.03	Khe Dui
D451A	20	0.94	1.7	0.06	0.01	0.01	0.09	0.01	<0.03	Khe Dui
D452A	grab	0.03	0.3	<0.01	<0.01	<0.01	0.01	<0.01	<0.03	Khe Dui
D453A	grab	0.83	0.5	<0.01	<0.01	<0.01	0.04	<0.01	<0.03	Da Mai
D455A	15	0.02	0.4	<0.01	<0.01	<0.01	0.01	<0.01	<0.03	Da Mai
D456A	42	0.02	0.3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.03	Da Mai
D457A	30	0.02	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.03	Da Mai
D458A	30	0.07	0.2	0.01	<0.01	<0.01	0.02	<0.01	<0.03	Da Mai
D459A	13	0.31	0.3	0.01	<0.01	<0.01	0.05	<0.01	<0.03	Da Mai
D460A	40	0.04	<0.2	0.02	0.01	<0.01	0.01	<0.01	<0.03	Da Mai

Mo Dong Formation (C_{md})

The Mo Dong Formation is composed of gray to greenish gray sandstone, quartzitic sandstone, psammitic schist and sericite schist of the Cambrian System. This is the oldest rock of this area. The Mo Dong Formation crops out widely in the western part of the survey area and forms the major host rocks of mesothermal gold deposits. The representative localities of this formation are: Khe Gang, Ngan Me, and Da Mai.

Tang Sa Formation (C_{3ts})

The Than Sa Formation overlies on the Mo Dong Formation with lens of conglomerate. It corresponds to the Cambrian System, and forms the host rocks of mesothermal gold deposits together with the Mo Dong Formation in the western part of the survey area. This formation is subdivided into three series: Than Sa duoi (lower), Than Sa giua (middle), and Than Sa tren (upper). These are composed of gray to dark gray sandstone, quartzitic sandstone, psammitic schist, and multi-color schist. Layers of marly limestone and/or chalky clay are intercalated in the sandstone. Schistosity is better developed in the lower series of this formation. The major localities are: Cay Thi, S. Ngan Me, and S. Dien in the southwestern area.

Na Mo Formation (O_{nm})

The Ordovician System is named the Na Mo Formation in the Bo Cu area. It is composed of gray quartzitic sandstone, psammitic schist, black slate and phyllite. The locality is: S. Nang in the northwestern area.

Bac Bun Formation (D_{1bb})

The lower Devonian System is called The Bac Bun Formation. It is mainly composed of a series of sandstone, which shows gray to light gray and various features: coarse sandstone, quartzitic sandstone or psammitic schist, with intercalations of violet red color schist to reddish brown claystone (sometimes weakly schistose). A conglomerate unit occurs at the bottom of this formation. A muddy part of the claystone sometimes contains shell fossils. The major localities are: S. Lu (a branch of Song Rong), Song Mo Ga (where it is fault contacted with limestone), and S. Y Tich (eastern area).

Mia Le Formation (D_{1ml})

A thick pile of limestone occurs from the lower Devonian up to the Permian System; some are continuous to the lower Triassic. The lower Devonian limestone is named the Mia Le Formation. It is composed mainly of marly limestone, partly of chalky claystone, and rarely of psammitic schist and schist. The major localities of the Mia Le Formation are: La Meo (limestone with several thin layers of black schist, eastern area), Gop Nien (a village in the northernmost area), and S. Lang Rong (northern area).

Na Quan Formation (D_{2nq})

The middle Devonian limestone is called the Na Quan Formation. It is composed mainly of dark gray crystalline limestone, partly siliceous (cherty). It occurs at: Nga Hai (northern area), and Na Dong (northern area).

Bac Son Formation ($C\text{-}P_{bs}$)

The thick limestone layer of the Carboniferous to Permian System is named the Bac Son Formation. It shows various limestone features: gray to light gray massive limestone, dolomitic limestone, oolitic limestone, crystalline limestone, marly limestone, siliceous (cherty) limestone, etc. It occurs widely over the central to the eastern part of the survey area. The major localities are: north of Dan Tien, S. Loi (branch of Song Thuong), and S. Buc (central area).

Dong Dang Formation (P_{2dd})

The Dong Dang Formation is a thin (about 200 m) Permian formation comprising mainly limestone and claystone. The limestone shows dark color, and is massive, marly. The claystone, occasionally silty, occurs locally at the bottom of this formation. Bauxite occurs in some part of claystone near the boundary to limestone after the enrichment of alumina component when weathered. It is a characteristic feature of the Dong Dang limestone. The Dong Dang Formation overlies unconformably on the Bac Son limestone in some area. The major localities are: Ban So (upstream of Ban Chau), and S. Mo Roong (northern area).

Lang Son Formation (T_{1ls})

The Triassic System is divided into five formations, and this is the lower Lower-Middle System of them. It is mainly composed of gray phyllitic sandstone. It accompanies some normal (not metamorphosed) sandstone and siltstone. In the upper part of this formation, limestone with thin bands of chalky clay occurs. The Lang Son sandstone occurs at the upper reaches of Ban Chau, upper reaches of Song Thuong, and S. Na Dong (northern area).

Song Hiem Formation (T_{1-2sh})

The Song Hiem Formation is the second Lower-Middle Triassic System in the Bo Cu area. It is mainly composed of rhyolite lava flows. The rhyolite shows green to greenish gray, massive, porphyritic features. It sometimes jointed. Phenocrysts of quartz and plagioclase of up to 3 mm in diameter are seen in the rock. Under the microscope, phenocrysts of plagioclase, quartz, potash-feldspar and biotite were observed in a matrix of microcrystalline plagioclase and mosaic quartz. These minerals show porphyritic texture. In the upper part of this formation, layers of rhyolitic tuff (tuff and tuff-breccia), sandstone, siltstone and conglomerate occur locally. The major localities of the Song Hiem Formation are: upper reaches of Ban Chau, S. Tra (a branch of Song Thuong, at which rhyolitic tuff-breccia occurs below rhyolite lava), Song Trung (at which sandstone is intercalated within rhyolite lava), and Binh Gia gold mine (northern outside the survey area).

Na Khuat Formation (T_{2nk})

The Na Khuat Formation is one of the third Lower-Middle Triassic System in the Bo Cu area. It is composed of lower limestone and upper clastic sediments. The lower part of the Na Khuat Formation consists of gray to dark gray limestone. Claystone (some part muddy), siltstone and sandstone are the main members of the upper part. The claystone shows various color: light gray, gray, whitish gray, dark gray, reddish brown, and yellowish brown. It is weakly metamorphosed and phyllitic in some part. An alternation of limestone and siltstone occurs intermediately between lower limestone member and upper clastic member. The Na Khuat Formation occurs mainly at: lower to middle reaches of Ban Chau (Van Gieng), S. Tan Thanh (southwestern area), and south of Trai Cau.

Mau Son Formation (T_{3cms1})

The upper Triassic System is divided into two: lower Mau Song Formation and upper Van Lang Formation. The Mau Son Formation is composed of sandstone, claystone and conglomerate. This formation occurs locally at the southern part of the survey area such as: upper reaches of S. Tan Thanh, and S. Oc.

Van Lang Formation ($T_{3n\text{-}rvl2}$)

The Van Lang Formation is composed of sandstone, claystone and conglomerate. This formation occurs locally at the southern part of the survey area (Dong Hun).

Quaternary Series (Q)

The Quaternary Series is composed of gravels, sands, silts and clays along the alluvial plains in the Bo Cu area. It occurs at the southern part of the survey area. The localities are limited; along Song Rong and Song Trong,

1-2-3 Intrusive Rocks

Small stocks of granite occur near Binh Gia in the northern part of the survey area. There is no other outcrop within the survey area.

Outside the survey area, the late Triassic biotite granite occurs 50 km northwest from the western boundary of the survey area; the Cretaceous granite also occurs to the southwest of the survey area.

Near the Da Mai, Khe Gang and Ngan Me areas, there were thought to be cryptobatholiths of granitic rocks, which were considered to be something related to the mesothermal gold mineralization in those areas. Some report showed the existence of a small granite body south of Da Mai in the map (General Department of Geology & Mineral Resources, 1988). No such evidence, however, has been found in the first phase field survey.

Granite ($T\text{-}C_g$)

Three small stocks of granite crop out near Binh Gia. The dimension ranges from a few hundred meters to 2 km in diameter on the surface. They occur within marly limestone and calcareous sandstone of the Bac Bun Formation and Mia Le Formation. They show gray to light gray color, massive granular features, composed of phenocrysts of quartz, potash-feldspar, biotite and plagioclase. Under the microscope, phenocrysts of quartz, plagioclase, potash-feldspar and biotite were observed. These minerals show hypidiomorphic granular texture. Some handspacimen slightly show cataclastic texture which forms fissures filled by cryptocrystalline silica, flaky chlorite, sericite and fine-grain epidote. Small amounts of tourmaline, zircon and opaque minerals are contained.

These three stocks, separated for 500 m to 5 km each other, are arranged in the ENE-WSW direction. They are interpreted to be connected below the surface. The time of emplacement of these stocks are considered to be sometime between Triassic and Cretaceous from the regional distribution.

Whole Rock Analysis

Twenty rock samples were provided for whole rock analysis. Thirteen major components including Cr_2O_3 and LOI were analyzed. Results of chemical analysis and CIPW norm calculation are shown in a table in the first phase report. Names of igneous and volcanic rocks identified from field observations and thin sections were checked and confirmed through the whole rock analysis.

Regarding eight granite samples, the results of the CIPW norm calculation were plotted on the Q (quartz)-A (potash-feldspar)-P (plagioclase) diagram. Most of the samples appear in the region of quartz-rich granitic rocks. The type and series of felsic magma of these granite samples were also examined by the whole rock analysis together with the petrographical studies. The results indicate that

these samples belong to the magnetite series (Ishihara et al, 1977) and the S-type (Chappell & White, 1974) granitoids.

1-2-4 Geologic Structure

Fold Structure

Geostructural scheme is established on the basis of geologic evolution and the age of fold movement. The Bo Cu area is structurally characterized by a series of anticlines and synclines collectively called Bac Son anticlinorium. It is elongated from Bo Cu mountain following east to northeast to Bac Son, Dong Mo until Lang Son. It is well-proportioned; the southern side is cut by a fault running along the national road No. 1a and Quynh Dong-Bo Ha fault. The northern side is componented by Mesozoic formations. The axis of the anticlinorium orientates to ENE-WSW to NE-SW. It passes through Bo Cu, Mo Nhai and Bac Son. It is composed of terrigenous, terrigene-carbonate, carbonate, and terrigene-volcanic sediments of the middle Cambrian to the middle Triassic in ages. The total thickness is about 10,000 m. The Bac Son anticlinorium consists mainly of Bo Cu anticline, Bac Son anticline and Trang Xa-Nhat The syncline. The time of these folding activities is thought to be Mesozoic according to the explanatory note of the 1:200,000 geologic map.

Fault

Three major faults systems are distinguished in the Bo Cu area: NW system, N-S system and NE system.

Faults of NW system are normal, compound ones, generated earlier than those of NE system. The most prominent NW fault occurs in the southern part of the survey area, running from Thai Nguyen through Trai Cau and Quynh Dong down to Yen Thien. Both NW and SE sides are cut through Mesozoic strata, and partly covered by Quaternary sediments. This fault system is interpreted to be formed nearly at the same time as the Bo Cu anticlinal activity.

Faults of N-S system occur in two areas: May Khoan-Khao Lien-Deo Giao, and Coc Vuong-Dong Khuong. These sublongitudinal faults are cut in many places by faults of NE system.

Faults of NE system occur pervasively over the survey area. They are subdivided into two groups: northwestern group and southeastern group. These faults cut both those of NW system and N-S system. Along these faults, intense deformation and shearing are observed.

According to the satellite image analysis, extensive development of lineaments was observed. The major systems recognized on the JERS-1 SAR image are: ENE, NE, NNE, E-W and NW. Among them, those of NE to ENE are dominating.

1-2-5 Mineralization

Metallic and non-metallic mineral deposits whose occurrences were confirmed within the Bo Cu area during the field survey in the first phase are as follows:

- •Gold-bearing quartz vein
- •Alluvial gold
- •Galena lode
- •Magnetite lens
- •Phosphorite
- •Limestone (for quarrying)

The list of the major known mineral deposits is shown in a table in the first phase report. The details of each deposit are described below.

Gold-Bearing Quartz Vein

Gold-bearing quartz veins are known in five areas: Da Mai, Gang, Ngan Me, Cay Thi, and Bai Vang. These are thought to belong to the mesothermal gold deposit. The details of the occurrences of gold deposits in each area are described in the chapter of the detailed survey.

Alluvial Gold

Alluvial gold is dug at many places around the hard-rock gold deposits. The major localities are: Trai Cau (lower reaches of S. Ngan Me), Trai Gai (middle reaches of Trai Cau), and Xuan Luang (upper and middle reaches of S. Bai Vang). Gold occurs mainly at the bottom of the Quaternary alluvial sediments in those localities. Alluvial gold also occurs at a few meters deep in the rice-field soil. Gold-bearing quartz veins occurred several kilometers up those drainage systems are most likely the source of the alluvial gold.

Galena Lode

Galena lodes were found in five places: Tan Lan (middle reaches of Song Trung in the central southern area), Nui Cau Re (lower reaches of Song Trung in the central southern area), Lang Dang (southeastern area), Deo Len Muc (southeastern area), and Len Quang (southeastern area). These galena veins are narrow (20 to 40 cm in width) and discontinuous (up to several ten meters). They are

hosted mainly by limestone of Bac Son Formation. A small amount of sphalerite and pyrite also occur together with galena.

Magnetite Lens

Magnetite is concentrated in a particular horizon of siltstone and sandstone of the Jurassic Ha Coi Formation. It forms lenses of up to several meters. Magnetite lenses are outcropped near Trai Cau, and mined as iron ores. Magnetite mines are located a few km to the east and to the west of Trai Cau.

Phosphorite

Sedimentary phosphorite was found and mined at Vinh Thinh near Huu Lung in the southeastern area. Phosphorite occurs in limestone of the Bac Son Formation. Phosphorite ores at a grade of 25 to 30 % P_2O_5 were mined by the underground method intermittently between 1930's and 1992. It has been mined out, and now producing only limestone at this location.

Limestone

Limestone is wide spread from the eastern to the central parts of the Bo Cu area. It occurs mainly from the Mia Le Formation to the Dong Dang Formation. Limestone is quarried in many places. Most of them are small scale; sometimes mined by local people using hand-pick and dynamite. The limestone is sent mainly to the cement factories. Some of them are utilized for the other purposes such as road construction and building materials.

1-3 Stream Sediment Geochemical Survey

1-3-1 Sampling and Chemical Analysis

Stream sediment geochemical survey was carried out in the first phase for the purpose of defining hidden mineralized zones which would otherwise be undetected by geological survey, as well as for clarifying the extensions of mineral occurrences encountered through the geological traverse.

Fine sand samples of -80 mesh were collected from sediments in big tributaries along the major drainage systems. The number of stream sediment samples collected during the first phase survey was 1,514, which corresponded to a sampling density of approximately one sample per 1.3 km^2. The samples, after being air-dried in the field, were analyzed at the Analytical and Experimental Center of GSV for 8 elements: Au, Ag, Cu, Pb, Zn, As, Sb, and Hg.

1-3-2 Statistical Data Processing

The distribution of geochemical data of some elements tends to show a close approximation to the logarithmic normal distribution in most cases. After the mode of distribution being examined, the common logarithmic conversion of the respective analytical values was adopted, if necessary, in the statistical data processing. When an analytical value was less than the detection limit, a value half of the lower limit was substituted in the calculation.

At first, statistical properties of geochemical data were checked. Basic statistical figures were calculated. Distribution histograms of each element were drawn out. Correlation coefficients among 8 elements were examined.

Then the selection of threshold values for anomalies was made. The cumulative frequency distribution of each element which showed the logarithmic normal distribution was plotted on the logarithmic probability graph using computer. If an element displayed any significant curvature, then the threshold was determined from the corresponding value on the curve. If any specific curvature was not recognized on the curve, then the threshold was calculated by the value of twice (or one time in some cases) the standard deviation added to the mean of the element. The thresholds of Au, Cu and Pb were obtained on the logarithmic probability graphs. While those of Ag, Zn, As, Sb and Hg were determined by the statistical calculation mentioned above.

A series of maps showing geochemical anomalies of stream sediments for each element was produced. Values of each sample were expressed by one of two kinds of symbols (anomalous or non-anomalous) on the map. Geochemical anomalies for each element were cross-checked on the maps. The results of geological survey, especially those of the distribution of mineralized and alteration zones, were also referred. Gold mineralization and associated alteration were presented by the

distribution of most of the analyzed elements in the stream sediment geochemistry. The Au anomalies of stream sediments were well-correlated with the occurrences of gold mineralized zones. The distributions of some other elements such as Ag, As and Hg also well-corresponded to the mineralized zones. The association of these geochemical elements was explained by the mineral assemblage of ores. Consequently these elements were thought to be good indicators of gold mineralization in this area. One strong Pb anomaly was detected in the Cuc Duong area (northwestern area). Anomalies of the other elements such as Au and Zn accompany with the Pb anomaly. This anomaly was interpreted as the galena mineralization described in the section below. Major analytical results of stream sediment samples are shown in Table 2-1-5.

These results were integrated together, and several significant anomalous zones were outlined. Some of the significant potential mineralized areas thus chosen are described in the next section. The distribution of geochemical anomalies was drawn by computer. An example of such maps as for Au is shown in Fig. 2-1-1.

1-3-3 Anomalies of Stream Sediment Geochemistry

Upper Reaches of S. (Suoi) Ca: Numerous Au anomalies and several anomalies of As and Cu of stream sediments were found along the southern side of the upper reaches of S. Ca. They showed significant anomalous values: up to 7,211 ppb Au (B031), up to 7,013 ppm As (ditto) and up to 510 ppm Cu (ditto). Weak Ag and Hg anomalies were also detected in this area. The distribution of these anomalies is well-correlated with the remarkable panning anomalies. Gold-bearing quartz veins in the Khe Dui prospect of the Da Mai area are situated at the upstream of this anomalous zone. Another group of Au anomalies of stream sediments was also detected on the other (southern) side of the ridge of the Da Mai area.

Northeast of N. (Nui) Bo Cu: Intensive Au anomalies of stream sediments were detected along a branch of S. Ca which flows from Nui (mount) Bo Cu. The maximum values reached to 12,295 ppb Au (B038). A few anomalies of As (up to 1,421 ppm) occurs in the same zone. Panning anomalies also occur in this zone. This zone is situated to the east of the upper reaches of S. Ca anomalous zone.

Middle Reaches of S. Hoan: Extensive Au anomalies and several anomalies of Ag, As, Pb and Hg of stream sediments were detected in this zone. They showed significant anomalous values: up to 2,418 ppb Au (A221), up to 1,060 ppm As (ditto), etc.. Many panning anomalies are also concentrated in this zone. These anomalies occur within and along the downstreams of the Khe Gang, Khe Hoac and Cay Thi prospects of the Gang area, where gold-bearing quartz veins were found.

Table 2-1-5 Major Analytical Results of Stream Sediment Samples (1)

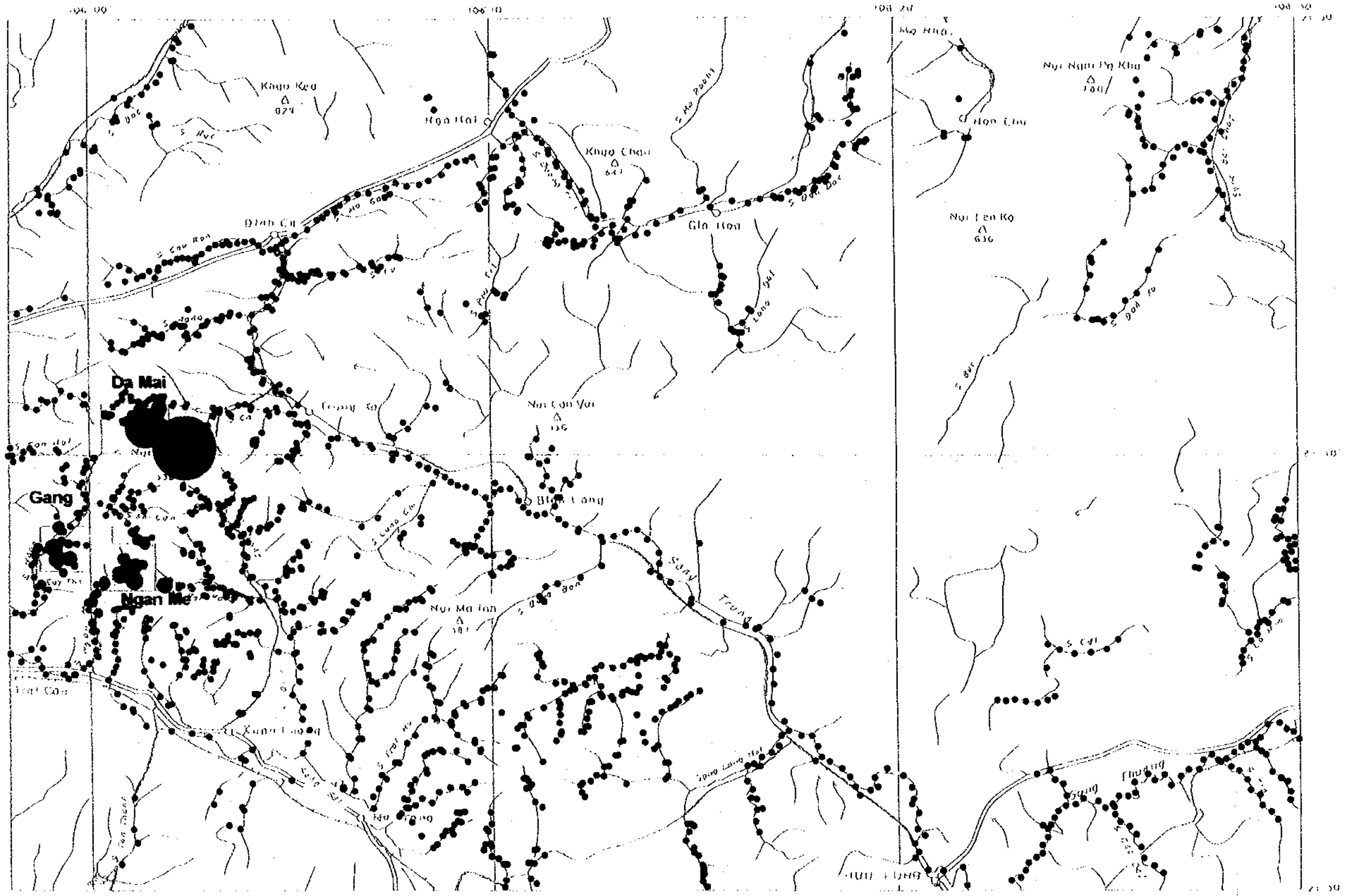
Sample No.	Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	As (ppm)	Sb (ppm)	Hg (ppm)
A053	25	0.8	105	8,725	878	220	49	0.06
A054	23	1.0	111	9,925	922	271	54	0.05
A094	64	<0.2	42	45	133	2	4	<0.03
A213	500	0.5	78	112	111	91	16	0.12
A214	97	0.3	85	115	97	108	16	<0.03
A215	2,290	0.9	46	112	66	664	14	0.11
A216	250	0.7	28	52	41	122	23	0.05
A219	1,940	0.9	55	77	57	988	10	0.24
A220	418	0.3	72	400	30	311	11	0.03
A221	2,418	0.6	39	93	58	1,060	7	0.08
A223	571	0.2	56	91	66	71	14	0.03
A224	358	0.3	21	73	24	44	11	<0.03
A225	61	0.5	41	54	91	11	8	<0.03
A231	96	<0.2	29	26	24	<1	3	0.72
A232	65	<0.2	23	41	50	<1	6	0.29
A233	66	<0.2	23	125	34	<1	2	0.16
A238	112	<0.2	17	39	47	60	2	0.08
A239	1,272	0.2	23	50	29	708	8	0.16
A240	1,073	0.3	23	51	46	615	7	0.11
A241	714	0.2	30	56	56	298	11	0.07
A243	74	0.2	34	59	66	67	7	<0.03
A247	446	<0.2	23	36	17	19	11	<0.03
A252	589	<0.2	59	40	46	14	<1	0.10
A253	96	<0.2	33	59	69	50	<1	0.31
A256	1,036	0.3	27	34	33	135	1	0.20
A259	607	<0.2	24	26	36	38	7	0.05
A260	1,821	<0.2	24	31	37	48	5	<0.03
A261	194	<0.2	17	23	36	13	3	0.05
A264	642	<0.2	21	21	27	13	6	<0.03
A265	732	0.4	28	113	51	534	7	0.30
A266	714	0.3	21	100	38	472	6	0.10
A267	1,142	0.2	29	73	43	1,208	4	0.13
A268	1,411	0.2	30	77	39	1,021	9	0.09
A274	85	0.2	14	21	23	11	2	0.03
B008	90	<0.2	6	24	31	7	3	<0.03
B012	356	<0.2	18	17	16	22	5	<0.03
B013	432	<0.2	27	29	36	12	9	<0.03
B014	455	<0.2	21	23	32	6	9	<0.03
B016	315	<0.2	12	34	35	6	3	<0.03
B018	1,184	<0.2	83	29	49	333	13	<0.03
B020	526	<0.2	13	22	18	7	9	<0.03
B022	2,053	<0.2	123	34	51	710	17	<0.03
B024	1,474	<0.2	150	38	57	891	18	0.04
B026	947	<0.2	45	44	96	232	10	0.03
B027	1,316	<0.2	213	43	65	1,361	23	0.07
B028	1,316	<0.2	146	35	48	1,199	21	0.04
B029	1,368	<0.2	220	43	63	1,421	24	0.06
B030	1,736	0.2	154	52	68	932	22	0.07
B031	7,211	0.5	510	69	100	7,013	70	0.16
B036	1,105	<0.2	28	37	30	162	16	<0.03
B037	1,789	<0.2	30	34	34	177	16	0.29

Table 2-1-5 Major Analytical Results of Stream Sediment Samples (2)

Sample No.	Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	As (ppm)	Sb (ppm)	Hg (ppm)
B038	12,295	0.4	30	40	36	1,421	16	0.94
B039	173	<0.2	32	33	48	76	9	0.09
B040	137	<0.2	24	25	32	43	13	<0.03
B042	88	<0.2	23	28	32	24	7	<0.03
B043	163	<0.2	20	28	35	11	7	<0.03
B044	134	<0.2	19	26	33	31	7	<0.03
B045	89	<0.2	20	20	30	11	7	<0.03
B063	62	<0.2	32	38	47	4	11	<0.03
B066	124	<0.2	36	34	38	49	11	<0.03
B119	157	<0.2	13	15	14	7	8	<0.03
B379	59	<0.2	30	23	37	2	3	0.12
C059	16	1.4	46	1,047	201	386	34	0.07
C061	20	1.1	75	3,055	431	397	28	0.04
C062	22	2.4	45	1,174	302	355	29	0.03
C063	106	<0.2	32	67	55	23	10	<0.03
C064	20	1.2	79	2,382	450	346	41	0.05
C297	2,054	<0.2	29	27	33	118	3	0.39
C299	80	<0.2	29	23	39	50	<1	<0.03
C309	70	<0.2	17	12	14	15	8	0.03
C313	74	<0.2	23	19	28	11	1	<0.03
C315	77	<0.2	20	18	25	10	<1	<0.03
C316	59	<0.2	24	22	28	17	5	<0.03
C323	200	<0.2	18	17	30	11	2	<0.03
C328	60	<0.2	18	13	18	12	4	0.03
C351	54	<0.2	17	13	23	6	5	<0.03
C373	98	<0.2	18	19	26	3	9	<0.03
C424	283	<0.2	15	6	5	6	1	<0.03
D074	201	<0.2	17	25	27	9	1	<0.03
D308	941	<0.2	32	42	47	225	<1	0.11
D309	294	<0.2	45	95	61	47	7	0.05
D311	735	<0.2	33	56	47	280	11	0.08
D312	529	<0.2	35	46	41	280	19	0.07
D314	588	<0.2	33	37	39	174	7	0.05
D315	232	<0.2	25	38	31	170	24	0.07
D316	51	<0.2	18	25	17	42	1	<0.03
D317	107	<0.2	18	38	41	142	17	0.05
D318	156	0.2	27	44	31	85	<1	0.04
D319	71	<0.2	30	37	34	72	6	0.04
D321	175	<0.2	25	32	33	129	<1	0.03
D324	65	<0.2	21	55	26	65	4	0.10
D331	84	<0.2	15	28	29	33	2	<0.03
D335	586	0.3	41	168	67	82	15	0.09
D338	51	<0.2	18	44	26	38	4	<0.03
D340	53	<0.2	24	123	44	36	9	<0.03
D342	123	<0.2	22	49	35	31	10	<0.03
D343	71	<0.2	18	46	27	64	15	<0.03
D344	236	<0.2	36	31	30	166	20	0.04
D347	280	<0.2	28	29	32	136	14	0.08
D349	52	<0.2	26	25	24	16	5	0.06
D357	50	<0.2	19	24	15	27	5	0.03
D364	149	0.2	27	108	40	50	29	<0.03

Table 2-1-5 Major Analytical Results of Stream Sediment Samples (3)

Sample No.	Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	As (ppm)	Sb (ppm)	Hg (ppm)
D365	112	<0.2	13	28	17	32	5	<0.03
D366	1,238	0.8	27	161	30	110	101	0.16
D368	500	<0.2	20	90	38	54	14	<0.03
D370	112	<0.2	15	62	29	61	31	0.12
D421	92	<0.2	36	59	36	353	14	0.09
D422	625	<0.2	43	64	60	143	28	0.05
D424	286	<0.2	30	38	33	120	2	<0.03
D425	85	<0.2	40	41	60	62	20	0.23
D427	794	0.3	31	70	42	484	19	0.10
D428	647	<0.2	30	58	45	300	15	0.14
D429	1,500	<0.2	26	49	31	115	14	0.17
D430	353	0.2	46	70	44	824	27	0.40
D431	2,448	0.4	32	87	48	992	28	0.52



Stream Sediment - Au (ppb)

Circle size proportional to Au (ppb)

Fig. 2-1-1 Distribution of Stream Sediment Geochemical Gold Anomalies in the Bo Cu Area

Upper Reaches of S. Ngan Me: From the lower reaches to the upper reaches of S. Ngan Me, a series of stream sediment anomalies was found continuously. They showed significant anomalous values: up to 2,448 ppb Au (D431), and up to 1,208 ppm As (A267). Extensive panning anomalies are also distributed. The Ba Khe prospects (Ba Khe, West Ba Khe, Upper Reaches of Ba Khe, etc.) of the Ngan Me area are located at the upstream of these anomalies.

Upper Reaches of S. Bai Vang: A couple of Au anomalies was discriminated along the upper reaches of S. Bai Vang. Although the level of Au anomalies is high (up to 2,054 ppb, C297), the other elements are comparatively low. A group of panning anomalies was also distributed in this zone. This zone is situated to the east of the Ngan Me area.

Cac Duong: Several strong Pb anomalies were discovered at Cac Duong in the northwestern area. The Pb anomalies reach to 9,925 ppm (A054). Au (up to 106 ppb, C063), Zn (up to 922 ppm, A054) and As anomalies are accompanied. Values of Ag and Hg are also slightly anomalous. Gold was observed in two pan concentrate samples in this zone.

1-4 Panning Survey

1-4-1 Sampling and Heavy Mineral Identification

Panning survey was carried out in the Bo Cu area in the first phase for finding alluvial mineral showings originated from gold and other mineralization zones.

Pan concentrate samples were collected from trap sites in every active branch channel about 50 to 100 m upstream from the junction. Three backetfuls of sand and gravel which were about 3 liters were gathered and carefully panned out. A traditional Vietnamese hexagonal pan was used. A panned sample of about 5 grams was obtained finally at every point. Fineness and number of gold grains were measured, and the heavy mineral composition was examined roughly by roupe in the field and systematically under the binocular microscope in the laboratory.

The procedure of gold and heavy mineral analysis is illustrated in a figure in the first phase report. Four hundred and five panned samples were collected in the Bo Cu area.

1-4-2 Occurrences of Gold and Heavy Minerals

Gold was detected in 133 samples either by naked eye in the field (66 of them) or under the microscope in the laboratory (120 of them). It stands nearly 33 percent of the total amount of samples obtained in the Bo Cu area. It is composed of coarse to very fine carat of gold up to 2.6 mm by 1.5 mm (B019P taken at S. Ca). Gold grains generally show a golden color, typical metallic luster, clean surface and rugged relief. They are anhedral, irregular particles. Some of them show a foliage-like shape; others are needle shape. The flaky grains are found in only 2 occurrences.

The major heavy minerals observed in pan concentrates are: zircon, rutile, ilmenite, garnet, tourmaline, apatite, leucoxene, siderite, monazite, anatase, corundum, magnetite, hematite, limonite and the other iron-oxides. Sulfide minerals such as pyrite, arsenopyrite, chalcopyrite, galena, sphalerite and cinnabar were found in pan concentrates mainly near mineralized zones. Other minerals identified in the panned samples under the microscope are: xenotime, chromite, psilomelane, brookite, sillimanite, diaspore, boemite, cassiterite, native copper, pyromorphite, native lead, and cerussite.

Some heavy and sulfide minerals display a good association with gold in pan concentrates. A small amount of tourmaline sometimes accompanied by gold. Arsenopyrite was observed in most samples in which gold was found. Chalcopyrite was detected in two samples in which gold was found along S. Ca. Pyrite was observed in most pan concentrates, and no particular association with gold has been recognized. Cinnabar was detected in 39 samples. Most of them are very small grains. Gold was counted in 12 out of the 39 samples; it has not any intimate relationship. No silver mineral was found in pan concentrates in the Bo Cu area.

Galena was found in 6 samples. Three of them were obtained in the pan concentrates near the occurrences (or supposed occurrences) of galena lodes: Cuc Duong (C064P), Deo Len Muc (C186P), and Tan Lap (C203P).

1-4-3 Anomalies of Panning Survey

The major localities where gold, some indicator minerals for gold mineralization and other base-metal mineralization were detected by panning survey are the following places. The distribution of panning gold anomalies is shown in Fig. 2-1-2.

Upper Reaches of S. Ca: Many gold grains were obtained in almost all panned samples along the southern side of the upper reaches of S. Ca. Arsenopyrite was frequently found in the same samples. Chalcopyrite was detected in two samples. Gold-bearing quartz veins of the Da Mai area occur at the upstream of this anomalous zone. This panning anomalous zone almost overlaps to the stream sediment anomaly. Gold grains were also found in some pan concentrates along the upper reaches of S. Hoan situated at the other side of the ridge of the Da Mai area.

Northeast of N. Bo Cu: Gold grains were detected in almost all panned samples taken along a branch of S. Ca in this area. Arsenopyrite was found in two samples. Stream sediment anomalies also occur in this zone.

Middle Reaches of S. Hoan: Gold grains were obtained in some panned samples taken along S. Hoan and its branches (Khe Gang, Khe Hoac, Cay Thi, etc.). Arsenopyrite was found in some of the samples. The distribution of the panning anomalies almost overlaps to the stream sediment anomalies.

Upper Reaches of S. Ngan Me: Many panning anomalies comprising gold and arsenopyrite occur from the upstream to the downstream of S. Ngan Me.

Upper Reaches of S. Bai Vang: Gold grains were detected in nearly ten panned samples at the upper reaches of S. Bai Vang. Arsenopyrite was returned in two of them. A couple of stream sediment anomalies occur in this area as well. Several panning anomalies also occur at Xuan Luang and along S. Dien, both are situated to the east of the upper reaches of S. Bai Vang and in which alluvial gold is known.

Cac Duong: Gold grains were detected in three panned samples in this area. Galena and arsenopyrite were found in one sample each. It corresponds to the Pb and Zn anomalous zone of the stream sediment geochemistry.

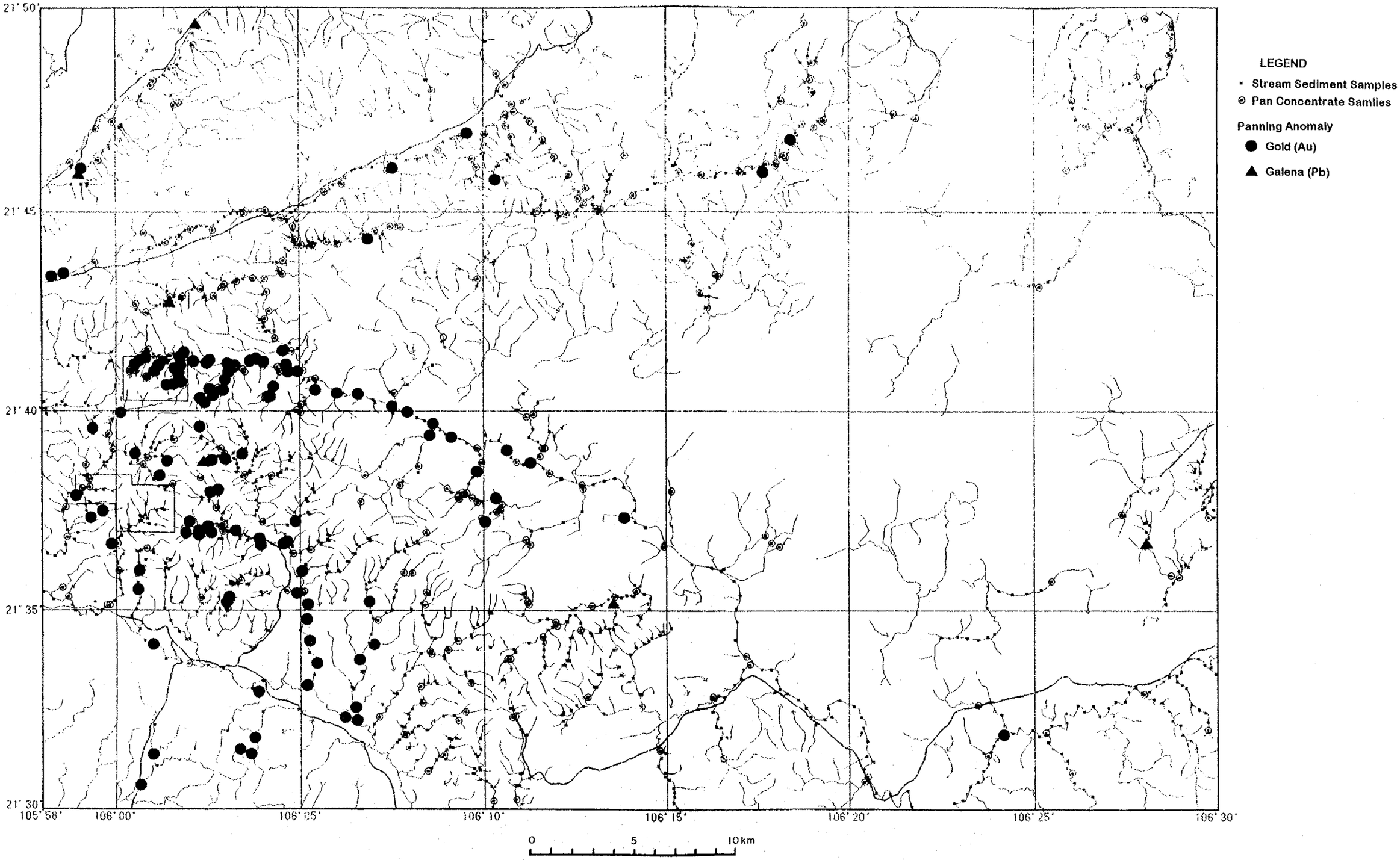


Fig. 2-1-2 Distribution of Panning Gold Anomalies in the Bo Cu Area

The other localities where gold grains were detected in pan concentrates in the first phase survey are as follows:

·Khe Ma (a branch of S. Ca, situated to the east of the northeast of N. Bo Cu)
·Upper Reaches of Khe Can (a branch of S. Hoan)
·South of S. Mo Ga (nothwestern area)
·S. Ban Dac (northeastern area)
·S. Dong Voi (a branch of S. Trung)
·S. Canh Nau (a branch of S. Soi)
·S. Tan Thanh (southwestern area)
·S. Oc (southwestern area)

1-5 Discussion

The geological features of the Bo Cu area consist of sedimentary and metamorphic rocks of Cambrian, Ordovician, and Devonian to Jurassic systems. Acidic volcanics occur in the lower-middle Triassic system. The major part of these geologic units exhibits the NE-SW to ENE-WSW direction which represents the characteristics of the regional geologic structure (eastern part of the Vietbac geological district), and forms a complex folding structure (anticlinorium). Moreover, the area is cut into many blocks by tectonic faults. Intrusive of a large-scale igneous complex was not found in this area; only small stocks of granite occur within and in the vicinity of the Bo Cu area..

The Bo Cu area is structurally characterized by a series of anticlines and synclines named Bac Son anticlinorium comprising Bo Cu anticline, Bac Son anticline and Trang Xa-Nhat The syncline. The major directions of these folding axes are NE-SW to ENE-WSW in the northwestern to the eastern part. Whereas in the southwestern part of the survey area, there is a distinctive anticlinal structure whose axis trends WNW-ESE. Most of gold-bearing quartz veins occur at the top and on the flank of this anticline.

Three major faults systems -- NW, N-S and NE -- were distinguished in the Bo Cu area. The NW faults are cut through Mesozoic strata, and was interpreted to be formed nearly at the same time as the Bo Cu anticline. The N-S faults were formed at the same time as the NW faults. The NE faults cut both NW and N-S faults, and was thought to be formed after the major folding activity. Along these faults, intense deformation and shearing were observed.

The main orogenic activity in the Bo Cu area was interpreted to be occurred in the Triassic or later period (Indosinian). The formation of the Bo Cu anticline, the formation of regional tectonic faults and acid volcanic activity in the Song Hiem Formation unanimously indicate the importance of this period.

Outcrops of small granite bodies occur at the northern part of the survey area arranging in the ENE-WSW direction. The time of emplacement of this granite was thought to be Triassic to Cretaceous. This granite belongs to the granitoids of the magnetite series and the S-type according to the whole rock analysis. No other igneous body was found in this area. Outside the survey area, similar bodies are known; the late Triassic biotite granite occurs 50 km northwest from the western boundary of the survey area; the Cretaceous granite also occurs to the southwest of the survey area. Tectonic loci of these granitic emplacements are considered to be at the marginal zone of the South China plate. However, the details such as the relationship to the mesothermal gold mineralization are not clear at the moment.

Two significant mineralizations, gold-bearing quartz veins and galena lodes, were observed within the Bo Cu area.

The gold-bearing quartz veins belong to the mesothermal type gold deposit. The occurrence of gold veins is characterized structurally by the spatial closeness to the Bo Cu anticline. The details of the mineralization and alteration are discussed in the chapter of the detailed geological survey.

The galena lodes occur mostly in the Bac Son limestone, and partly in claystone. Some of them contain significant amount of lead and silver. The similar Pb-Zn deposits are known widely in the Thai Nguyen and Cho Dien areas (west of the Bo Cu area). They are galena-sphalerite-pyrite veins/lenses hosted by carbonate rocks and schist of the Silurian to Devonian systems. They occur along faults which were thought to be controlled by the folding structure. Some spatial relationship of mineralization with the distribution of igneous bodies were said to exist in these areas. Although resources of the galena lode in the Cho Dien area is significant, the potential in the Bo Cu area may be small from the results of the regional survey.

Several significant anomalous zones were outlined through the stream sediment geochemical survey in the first phase. The major anomalous zones thus defined are: upper reaches of S. Ca, northeast of N. Bo Cu, middle reaches of S. Hoan, upper reaches of S. Ngan Me, upper reaches of S. Bai Vang, and Cuc Duong.

Upper Reaches of S. Ca: Numerous Au anomalies (up to 7,211 ppb) and several anomalies of As (up to 7,013 ppm), Cu (up to 510 ppm), Ag and Hg of stream sediments were found. They are well-correlated with the remarkable panning anomalies. These anomalies were interpreted to be originated from gold-bearing quartz veins in the Da Mai area.

Northeast of N. Bo Cu: Intensive Au anomalies (up to 12,295 ppb) and a few As anomalies (up to 1,421 ppm) were detected. Panning anomalies also occur in this zone. The source of these anomalies was interpreted to be the eastern extension of gold mineralization in the Da Mai area.

Middle Reaches of S. Hoan: Extensive Au anomalies (up to 2,418 ppb) and several anomalies of Ag, As (up to 1,060 ppm As), Pb and Hg of stream sediments were detected. Many panning anomalies are also concentrated in this zone. These anomalies were interpreted to come from the gold prospects of Khe Gang, Khe Hoac and Cay Thi.

Upper Reaches of S. Ngan Me: Continuous stream sediment anomalies (up to 2,448 ppb Au, and up to 1,208 ppm As) were found from the lower reaches to the upper reaches of S. Ngan Me. Extensive panning anomalies are also distributed. These anomalies were interpreted to be originated from the gold-bearing quartz veins in the Ngan Me area.

Upper Reaches of S. Bai Vang: An Au anomalous zone (up to 2,054 ppb) of stream sediments was discriminated along the upper reaches of S. Bai Vang, where a group of panning anomalies was distributed. This zone is situated to the east of the Ngan Me area, and the source of the anomalies was interpreted to be the eastern extension of gold mineralization in the Ngan Me area.

Cac Duong: Several strong Pb anomalies (up to 9,925 ppm) were discovered at Cac Duong. Au (up to 106 ppb), Zn (up to 922 ppm), As, Ag and Hg anomalies are accompanied. Two panning anomalies were found in this zone. The geology of this zone is composed of the Bac Son limestone and Son Hiem shale, these are fault-contacted in the ENE-WSW direction. Wastes of lead smelting were found at the upper reaches of S. Cau Ran in this area. Based on these evidences, lead mineralization, probably that of the galena lode type, may be exist in this anomalous zone.

The correspondence of metallic elements is well each other as far as the gold mineralization is concerned. Generally, they occur in the concentrated form at some small areas. As showed the best association with Au. Ag, Hg and in some area Cu follow to As. Unfortunately detection limits of Ag and Hg were considerably rougher than the required level. Panning anomalies were matched almost exactly with the stream sediment anomalies in the survey area.

Several significant anomalous zones were outlined through the panning survey in the first phase. The major anomalous zones thus defined are: upper reaches of S. Ca, northeast of N. Bo Cu, middle reaches of S. Hoan, upper reaches of S. Ngan Me, upper reaches of S. Bai Vang, and Cac Duong.

Upper Reaches of S. Ca: Many gold grains frequently accompanied by arsenopyrite and some by chalcopyrite were obtained in almost all panned samples in this locality. This panning anomalous zone almost corresponds to the stream sediment anomalous zone, and was interpreted to be originated from gold-bearing quartz veins of the Da Mai area.

Northeast of N. Bo Cu: Gold grains were detected in almost all panned samples taken along a branch of S. Ca in this area. Arsenopyrite was found in two samples. This panning anomalous zone almost corresponds to the stream sediment anomalous zone, and was interpreted to be the eastern extension of gold mineralization in the Da Mai area.

Middle Reaches of S. Hoan: Gold grains and arsenopyrite were obtained in some panned samples. The distribution of the panning anomalies almost overlaps to the stream sediment anomalies. These anomalous zones were interpreted to be originated from the gold-bearing quartz veins in the Gang area.

Upper Reaches of S. Ngan Me: Many panning anomalies comprising gold and arsenopyrite occur from the upper reaches to the lower reaches of S. Ngan Me, and was interpreted to come from the gold-bearing quartz veins in the Ngan Me area.

Upper Reaches of S. Bai Vang: Gold grains and arsenopyrite were detected in ten and two panned samples respectively at the upper reaches of S. Bai Vang, where a couple of stream sediment anomalies occurs. This anomalous zone is located to the east of the Ngan Me area, and the source of anomalies was thought to be the eastern extension of gold mineralization in the Ngan Me area.

Cac Duong: Gold grains were detected in three panned samples. Galena and arsenopyrite were found in one sample each. It corresponds to the stream sediment anomalous zone. As mentioned in the chapter of stream sediment survey, these panning anomalies may indicate the existence of galena veins in this area.

The other localities where gold grains were detected in pan concentrate samples in the first phase survey are: Khe Ma, upper reaches of Khe Can, south of S. Mo Ga, S. Ban Dac, S. Dong Voi, S. Canh Nau, S. Tan Thanh, and S. Oc. Khe Ma is located to the east of the northeast of N. Bo Cu anomalous zone, and the gold mineralization of the Da Mai area is expected to extend to this localities for nearly 5 km. Gold grains and some arsenopyrite were detected along the upper reaches of Khe

Can. It is situated to the east of the Gang area. Several gold anomalies in pan concentrates were also detected along Khe Cam, a branch of S. Bai Vang and located to the far east of the upper reaches of the Khe Can anomaly. Gold mineralization is expected to occur between the upper reaches of Khe Can and Khe Cam. Regarding the other six localities, some were interpreted to be accompanied by alluvial gold occurrences. Others were thought to be originated from gold-bearing quartz veins because quartz floats were seen near the panning anomalies.

Gold was detected in 133 pan concentrates either by naked eye in the field or under the microscope in the laboratory. It is composed of coarse to very fine carat of gold up to 2.6 mm by 1.5 mm. Gold grains generally show a golden color, typical metallic luster, clean surface and rugged relief. They are anhedral, irregular particles. Some of them show a foliage-like shape; others a needle shape. The flaky grains were occasionally found. From these features, gold grains in the Bo Cu area was thought to have been transported not far from the source.

Some heavy/sulfide minerals displayed a good association with gold in pan concentrates, and those associations can be explained by the mineral assemblage of gold-bearing quartz veins in the Da Mai, Gang or Ngan Me areas. Tourmaline and arsenopyrite showed a significant correspondence with gold. Chalcopyrite showed some intimate relationship with gold. Whereas, cinnabar did not show any relationship with gold in this area.

Galena was found in 6 samples. Three of them were from the pan concentrates near galena veins.

The results of panning survey were well-matched with the results of stream sediment geochemical survey.

Chapter 2 Da Mai Area

2-1 Introduction

Gold-bearing quartz veins are extensively developed in the Da Mai area. Semi-detailed and detailed surveys comprising geological survey, rock-chip geochemical survey, geophysical survey (CSAMT and IP methods), and drilling exploration have been carried out in the Da Mai area for three phases (Phase I, II and III). Some significant results for mesothermal gold deposit were obtained from these surveys.

2-2 Geological Survey

2-2-1 Outline of Survey

The semi-detailed survey consisting of geological survey, geochemical survey (stream sediment and panning surveys, as parts of the regional geochemical works mentioned in the above section) and geophysical survey (CSAMT method) was carried out in the Da Mai area in the first phase. The semi-detailed survey covered not only the Da Mai area but also Ngan Me and Gang areas in the first phase. The purpose was to survey mineral showings in the area, to catch geochemical anomalies and to define target mineralization for the next phase exploration. Geophysical survey using the CSAMT method was carried out in the semi-detailed survey area for the purpose of investigating the relationship between resistivity and geologic structure. The survey area was amounted to 16 km^2 in total three areas. The regional geologic map of 1:50,000 scale was generated as a result of this survey.

Based on the results of the first phase survey, which were composed of regional geological survey, stream sediment geochemical survey, panning survey, semi-detailed geological survey and geophysical survey (CSAMT method), two areas – Da Mai and Ngan Me areas – were selected for the potential gold prospects in the second phase detailed survey. These two areas were amounted to approximately 40 km^2 in total. Along with the detailed geological survey, detailed rock-chip geochemical survey was carried out in the second phase. The major themes followed in the detailed geological survey together with the detailed rock-chip geochemical survey were: (1) to survey mineral showings in the prospects, to catch geochemical anomalies, and to define target mineralization for the further exploration by means of the detailed investigation on geology and mineralization, and (2) to prepare geologic maps of 1:10,000 scale.

2-2-2 Semi-Detailed Geological Survey (Phase I)

(1) Survey Method

The gold-bearing quartz veins in the Da Mai area were preliminary surveyed in the first phase following to the regional geological survey. The occurrence of veins was investigated with some representative sketches of 1:50 to 1:100 scale and samples for assaying and laboratory works. The number of samples collected in the survey are: 103 ore samples for assaying, 40 vein and alteration zone samples for X-ray diffraction analysis, 31 ore samples for mineralogy, and 11 quartz samples for fluid inclusion studies (homogenization temperature). The results of these studies are shown in the summary tables. The summary of the Schumidt's stereo net projections of quartz veins is explained in the section of the detailed geological survey. The results of the fluid inclusion studies are explained in a section below.

(2) Geology and Mineralization

Tens of quartz vein outcrops and people's mining pits/adits are distributed on the flank and up to the top of the ridge (about 400 m above sea level) in the Da Mai area. The local people's mining activity in the Da Mai area has a relatively long history among the other areas in the Bo Cu area. The Division No. 1 of GSV (NE Geological Division of DGMV) started survey in 1988, and saw several mining pits/adits dug at a creek (now called the East Da Mai creek). The people's activity may be looked back to 1985 or earlier. In 1990, the Division made trenching survey in this area, and found some new quartz veins. A few months later, local miners rushed to the new veins, and a couple of mining camps was established along the creek and on the flank of the ridge.

Gold-bearing quartz veins in the Da Mai area are hosted by sandstone, shale and sericite schist of the Mo Dong Formation. The width of veins ranges from a few centimeters to a few meters. The major trend of vein systems is E-W to ENE. Most of the veins dip steeply to S with some exceptions of the N-dip. Gold is generally accompanied by a small amount of sulfide minerals. Arsenopyrite and pyrite are the two most common sulfide minerals; chalcopyrite and covelline were occasionally found in a bonanza of gold. The host rock beside the vein is slightly altered. The major alteration minerals are quartz and sericite.

The major prospects in the Da Mai area are: Da Mai (at the southern side of the ridge), Khe Dui (at the northern side of the ridge), and Goc Sen (at the top of the ridge). The Khe Dui prospect is situated 1 km east-northeast of the Da Mai prospect. Veins in these two prospects show the similar E-W trend. At the other side of the Da Mai prospect over the ridge (along a branch of S. Ca), there is another group of quartz veins named North Da Mai. Local people recently started mining there. Based on the results of geochemical survey, the gold mineralization of the Da Mai area extends to the east through the Northeast of N. Bo Cu until Khe Ma for more than 5 km.

The details of the occurrences of quartz veins in the major prospects are described as follows.

Da Mai: Gold-bearing quartz veins occur at two localities - East Da Mai creek and West Da Mai creek - in the Da Mai prospect. The East Da Mai creek is the oldest mining place in the Bo Cu area. More than ten old adits are distributed along the creek. The veins are subdivided into three groups: ENE-WSW, E-W, and NW-SE. They commonly dip 80 degrees to S. Shallow part of the veins have been almost mined out. Only low-grade ores remain now. According to the Division data, gold assays up to 36.38 g/t Au at 90 cm in width were returned. The West Da Mai Creek is the new people's mining place. Several adits were dug on the slope of the creek near the ridge. The veins trend E-W to WNW in this creek. They generally dip either S or N at about 60 degrees. Some veins dip gently. Quartz veins up to 1 m in width were found there. The glade of gold is rather low. The host rock adjacent to veins were sheared.

Khe Dui: Along Khe Dui (a branch of S. Ca), many gold anomalies were detected during the geochemical survey this phase. More than ten shafts, adits and prospecting pits are distributed along the upstream of the Khe Dui creek. The quartz veins in the Khe Dui prospect are arranged in the ENE-WSW direction for about 500 m. They generally dip to S at 60 to 80 degrees. The host rocks are sandstone and schist. Sheared, argillized and sulfide disseminated zones were sometimes observed along the veins.

Goc Sen: The Goc Sen prospect is located 500 m due south to the Khe Dui prospect. Several shafts and pits were dug at and near the top of the dividing ridge whose altitude is about 400 m above sea level. Quartz veins trend nearly E-W with a steep S dip. The mining activity has just started in this prospect, and every shaft/pit is still shallow. Gold grains were observed in one of ore samples collected in the Goc Sen prospect under the microscope. This sample contains a significant amount of arsenopyrite. A small amount of pyrite, pyrrhotite, galena and tetrahedrite was observed in the gold-rich part together with arsenopyrite under the microscope.

2-2-3 Detailed Geological Survey (Phase II)

(1) Survey Method

The second phase geological works in the Bo Cu area consisted of the target definition of the drilling survey for gold deposits and geological mapping.

Prior to the field work, a series of topographic maps of 1:5,000 scale was prepared from the compilation of existing topographic maps (1:25,000). Several sets of GPS instruments were employed for locating major surveying points in the field.

During the field works, geology, gold mineralization and alteration were surveyed, and samples for petrography, ore mineralogy and other laboratory studies were collected together with samples for assaying at every major outcrop and mineral showing. Features of mineralization and alteration such as silicification and sulfide impregnation were carefully checked in the survey. The major properties examined and recorded in the field note were as follows:

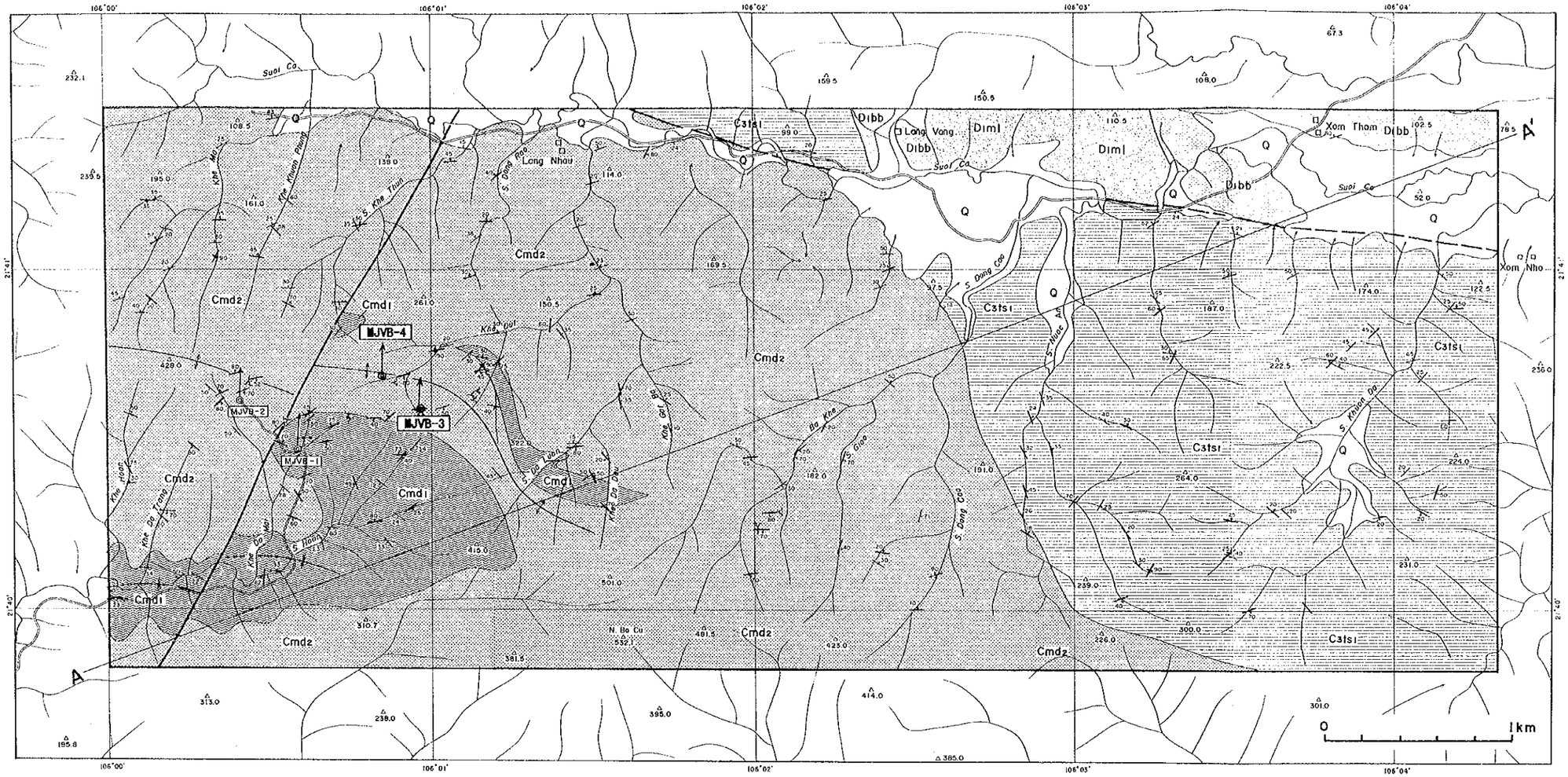
I. Vein property
   (1) Vein width, dip & strike
   (2) Nature of quartz vein (color, grain size, texture, appearance)
   (3) Contained ore minerals
   (4) Associated gangue minerals
   (5) Host rock

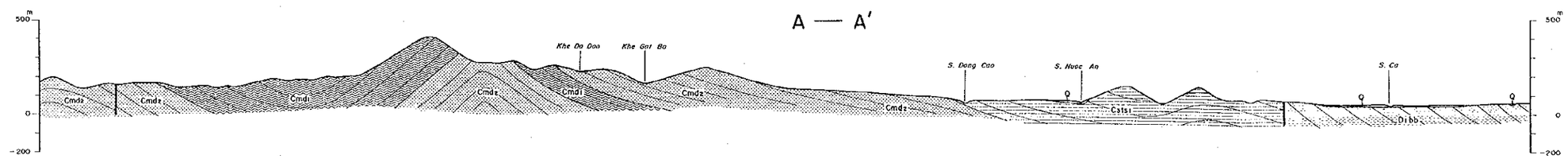
II. Wall-rock property
   (1) Alteration (kind, grade, color, hardness)
   (2) Sulfide dissemination (kind of sulfide minerals, degree of dissemination)
   (3) Wall-rock (name, formation, structure)

Several significant mineralized localities were found during the field survey in the second phase. The route maps of 1:5,000 scale were produced by these surveys. The important outcrops, mineral showings and old workings were studied in much detail (sketches of 1:50 to 1:200), and samples were taken for laboratory analysis.

A total length of 86 km was explored during the survey in the survey areas (Da Mai and Ngan Me), and the geological information was compiled into a geologic map of 1:10,000 scale. The geology and geologic profile of the survey areas are shown in Fig. 2-2-1.

The numbers of samples collected in the second phase survey are: 41 altered rock and quartz vein samples for X-ray diffraction analysis, 21 rock and quartz vein samples for thin sections, 30 ore samples for polished sections, 70 ore samples for assaying (Au, Ag, Cu, Pb, Zn and Fe), and 30 quartz vein samples for fluid inclusion study. The assay results of ore samples in the Da Mai area are shown in Table 2-2-1.





LEGEND

STRATIGRAPHY

Quaternary	Q	Q	Alluvial deposits
Devonian	Dimi	Dimi	Mia Le Formation
	Dibb	Dibb	Bac Bun Formation
Cambrian	C3ts1	C3ts1	Lower Than Sa Formation
	Cmd	Cmd	Mo Dong Formation 1 : alternation of schist and sandstone 2 : mainly composed of sandstone

OTHERS

- Fault
- 30 — Dip and strike of bedding / schistosity
- 70 — Dip and strike of quartz vein
- Anticlinal axis
- Synclinal axis
- Adit / inclined shaft
- Drill hole
- A—A' — Geologic section line

Fig. 2-2-1 Geology and Geologic Profile of the Da Mai Area

Table 2-2-1 Assay Results of Ore Samples in the Da Mai Area (Second Phase)

Ser. No.	Sample No.	Width (cm)	Au (g/t)	Ag (g/t)	Cu (%)	Pb (%)	Zn (%)	Fe (%)	Location	Remarks
Da Mai Area										
1	A002A	20	0.013	0.6	0.002	0.003	0.011	6.20	Da Luon	L-gray Qz vein, Py diss.
2	A005A	15	0.010	<0.5	0.002	0.004	0.003	1.15	Da Luon	Qz vein.
3	A009A	20	0.210	2.3	0.004	0.007	0.026	7.65	Dat Dau	Qz vein.
4	A011A	50	0.070	0.8	0.008	0.012	0.019	1.97	Dat Dau	L-gray Qz vein, Py diss.
5	A016A	20	0.008	<0.5	0.002	0.002	0.003	2.84	Left Side of Gac Ba	Qz vein.
6	A017A	15	0.010	0.7	0.004	0.005	0.003	5.05	Left Side of Gac Ba	Qz vein.
7	A019A	30	0.398	<0.5	0.003	0.006	0.002	1.30	Right Side of Thuon	White Qz vein.
8	A034A	30	0.010	<0.5	0.001	0.410	0.004	2.60	Lang Vang	L-gray Qz vein.
9	A041A	10	0.017	<0.5	0.002	0.130	0.002	2.36	Lang Vang	Qz vein.
10	A043A	20	0.006	<0.5	0.002	0.007	0.004	2.93	Lang Vang	White Qz vein.
11	A048A	20	0.006	<0.5	0.003	0.007	0.002	2.50	Dao	White/L-gray Qz vein.
12	A088A	20	0.459	<0.5	0.002	0.006	0.003	3.75	Cuc Tac	L-gray Qz vein.
13	A089A	25	3.598	0.6	0.002	0.018	0.005	4.09	Cuc Tac	L-gray Qz vein
14	A090A	115	0.037	<0.5	0.004	0.002	0.007	5.68	Cuc Tac	White/L-gray Qz vein.
15	A095A	70	0.067	<0.5	0.001	0.003	0.003	3.41	Cuc Tac	L-gray Qz vein.
16	A098A	15	0.007	<0.5	0.001	0.003	0.001	0.63	Cuc Tac	White/L-gray Qz vein.
17	A099A	10	1.539	0.6	0.005	0.008	0.007	3.90	Cuc Tac	White Qz vein.
18	A105A	5	2.232	<0.5	0.002	0.007	0.004	1.59	Cuc Tac	White Qz vein.
19	A225A	21	0.125	<0.5	0.004	0.007	0.003	3.49	Da Mai - adit	L-gray Qz vein.
20	A226A	6	0.033	<0.5	0.001	0.001	0.001	1.36	Da Mai - adit	L-gray Qz vein.
21	A227A	45	0.285	<0.5	0.002	0.004	0.002	2.02	Da Mai - adit	Qz vein.
22	A236A	23	0.010	<0.5	0.005	0.002	0.003	2.27	W-Da Mai - new road	White Qz vein.
23	A239A	5	0.008	<0.5	0.002	0.004	0.002	2.29	W-Da Mai	L-gray Qz vein, Limo diss.
24	A240A	10	0.043	<0.5	0.002	0.002	0.003	3.99	W-Da Mai	Qz vein.
25	A241A	10	0.050	<0.5	0.007	0.002	0.005	9.84	W-Da Mai	Qz vein.
26	A242A	5	0.175	<0.5	0.002	0.006	0.004	4.17	W-Da Mai	Qz vein.
27	A243A	10	0.050	<0.5	0.001	0.003	0.002	3.81	W-Da Mai	Qz vein.
28	A244A	8	6.890	<0.5	0.002	0.004	0.003	3.22	W-Da Mai	Qz vein.
29	A248A	33	0.071	<0.5	0.001	0.001	0.001	1.58	Khe Dui	White/L-gray Qz vein, visible Au.
30	A261A	13	0.436	<0.5	0.008	0.003	0.002	1.17	Khe Dui	White/L-gray Qz vein, visible Au.
31	A263A	45	13.385	4.0	0.014	0.001	0.001	1.06	Khe Dui	White/L-gray Qz vein, visible Au.
32	A264A	8	55.704	<0.5	0.004	0.003	0.002	2.06	Khe Dui	White/L-gray Qz vein, visible Au.
33	B010A	20	0.070	<0.5	0.003	0.006	0.004	2.55	Khe Dui	White/L-gray Qz vein, Py diss.
34	B011A	40	0.047	<0.5	0.003	0.004	0.004	4.71	Khe Dui	White Qz vein, Limo diss.
35	B012A	60	0.007	<0.5	0.002	0.004	0.004	3.90	Khe Dui	White Qz vein, Limo diss.
36	B013A	20	0.007	<0.5	0.001	0.001	0.001	0.91	Khe Dui	White Qz vein, Limo diss.
37	B014A	20	0.108	<0.5	0.004	0.011	0.008	6.16	Khe Dui	White Qz vein, Limo diss.
38	B015A	150	1.117	<0.5	0.005	0.004	0.003	2.12	Khe Dui	White/L-gray Qz vein, Limo diss.
39	B016A	100	0.043	<0.5	0.005	0.009	0.004	4.14	Khe Dui	White Qz vein, Limo diss.
40	B017A	10	0.010	<0.5	0.002	0.019	0.006	3.37	Khe Dui	White/L-gray Qz vein, Limo diss.
41	B018A	80	0.007	<0.5	0.002	0.004	0.004	3.10	Khe Dui	White Qz vein, Limo diss.
42	B029A	40	0.695	<0.5	0.002	0.003	0.003	4.23	Khe Ma	L-gray Qz vein, Py diss.
43	B031A	40	0.850	63.2	0.034	0.417	0.124	12.22	Khuon Phung	Qz vein, Limo diss.
44	B041A	20	0.030	<0.5	0.001	0.004	0.004	4.47	Nuoc An	White Qz vein, Limo diss.
45	B047A	15	0.003	<0.5	0.002	0.008	0.004	2.31	Nuoc An	L-gray Qz vein, Py diss.
46	B050A	20	0.053	<0.5	0.001	0.003	0.001	2.69	Dong Cao	L-gray Qz vein, Limo diss.
47	B066A	15	0.003	<0.5	0.001	0.002	0.003	3.08	S. Hoan	White/L-gray Qz vein, Limo diss.
48	B084A	15	0.043	<0.5	0.005	0.009	0.006	3.42	S. Hoan	L-gray Qz vein, Limo diss.
49	B092A	25	0.010	<0.5	0.002	0.002	0.002	2.41	S. Hoan	White Qz vein.

(2) Geology

The geology of the Bo Cu area is composed of six major stratigraphic units: Cambrian sedimentary rocks and schist with some limestone (Mo Dong Formation and Than Sa Formation), Ordovician sedimentary rocks and schist (Na Mo Formation), Devonian sedimentary rocks and schist with some limestone (Bac Bun Formation, Mia Le Formation and Na Quan Formation), Carboniferous to Permian limestone with some clastic rocks (Bac Son Formation and Dong Dang Formation), Triassic sedimentary rocks with interbedded acidic volcanic rocks (Lang Son Formation, Song Hiem Formation, Na Khuat Formation, Mau Son Formation and Van Lang Formation) and Quaternary sediments.

The general trend of these formations is ENE-WSW, E-W and WNW-ESE with local disorders. They form a series of foldings with the axes of NE-SW, ENE-WSW or WNW-ESE direction. These sedimentary-metamorphic formations are cut by numerous fault systems whose major trends are NW-SE, N-S and NE-SW. Small intrusive bodies of granite occur locally in these formations.

The survey areas in the second phase, where are located at the western part of the Bo Cu area, are composed stratigraphically of the following units:

Mo Dong Formation
Than Sa Formation (Lower Member)
Bac Bun Formation
Mia Le Formation
Quaternary sediments

Mo Dong Formation (C_{md})

The Mo Dong Formation is composed of gray to dark gray sandstone, quartzitic sandstone, psammite and sericite schist of the Cambrian System. An alternating bed of sandstone and schist (C_{md1}) occurs at the upper part of the thick sandstone strata (C_{md2}) of the Mo Dong Formation in the Da Mai and Ngan Me areas. Thin lens of limestone occurs locally at the upper part of this formation. This is the oldest rock of the Bo Cu area exposed on the surface. The Mo Dong Formation crops out widely in the survey area and forms the major host rocks of mesothermal gold deposits. The representative localities of this formation are: Da Mai, Ngan Me and Khe Gang.

Than Sa Formation (C_{3ts})

The Than Sa Formation overlies on the Mo Dong Formation. It corresponds to the Cambrian System. This formation is subdivided into three members: Than Sa duoi (lower), Than Sa giua

(middle), and Than Sa tren (upper). The lower member is outcropped within the survey area. It is composed of gray to dark gray sandstone, psammite, and multi-color (mainly violet) schist. Lens of marly limestone is intercalated in the sandstone. It forms the host rocks of mesothermal gold deposits together with the Mo Dong Formation. The major localities are: Cay Thi and Ngan Me (southwestern part).

Bac Bun Formation (D_{1bb})

The lower Devonian Series are called the Bac Bun Formation. It is mainly composed of a series of sandstone, which shows gray to light gray and various features: coarse sandstone, quartzitic sandstone or psammitic sandstone, with intercalations of violet red color schist to reddish brown claystone (sometimes weakly schistose) and limestone. A conglomerate unit occurs at the bottom of this formation. It occurs at the northeastern part of the Da Mai area

Mia Le Formation (D_{1ml})

A thick pile of limestone occurs from the lower Devonian up to the Permian Series; some are continuous to the lower Triassic. The lower Devonian limestone is named the Mia Le Formation. It is composed mainly of marly limestone, partly of chalky claystone, and rarely of psammite. It occurs at the northeastern part of the Da Mai area.

Quaternary Sediments (Q)

The Quaternary Series is composed of gravels, sands, silts and clays along the alluvial plains in the survey areas.

Intrusive Rocks

Small stocks of granite occur near Binh Gia in the northern part of the Bo Cu area. There is no other outcrop within the Bo Cu area. Outside the survey area, the late Triassic biotite granite occurs 50 km northwest from the western boundary of the Bo Cu area; the Cretaceous granite also occurs to the southwest of the Bo Cu area. Near the Da Mai, Khe Gang and Ngan Me areas, there were thought to be cryptobatholiths of granitic rocks, which were considered to be something related to the mesothermal gold mineralization in those areas. Some report showed the existence of a small granite

body south of Da Mai in the map (General Department of Geology & Mineral Resources, 1988). No such evidence, however, had been indicated in the field survey.

(3) Geologic Structure

The Bo Cu area is structurally characterized by a series of anticlines and synclines called Bac Son anticlinorium. It is elongated from Bo Cu mountain following east to northeast to Bac Son, Dong Mo until Lang Son. It is well proportioned; the southern side is cut by a fault running along the national road No. 1a and Quynh Dong-Bo Ha fault. The northern side is componented by Mesozoic formations. The axis of the anticlinorium orientates to ENE-WSW to NE-SW. It passes through Bo Cu, Mo Nhai and Bac Son. It is composed of terrigenous, terrigene-carbonate, carbonate, and terrigene-volcanic sediments of the middle Cambrian to the middle Triassic in ages. The Bac Son anticlinorium consists mainly of Bo Cu anticline, Bac Son anticline and Trang Xa-Nhat The syncline. The time of these folding activities is considered to be Mesozoic.

Three major faults systems are distinguished in the Bo Cu area: NW system, N-S system and NE system. Faults of NW system are normal, compound ones, generated earlier than those of NE system. The most prominent NW fault occurs in the southern part of the Bo Cu area, running from Thai Nguyen through Trai Cau and Quynh Dong down to Yen Thien. Both NW and SE sides are cut through Mesozoic strata, and partly covered by Quaternary sediments. This fault system is interpreted to be formed nearly at the same time as the Bo Cu anticlinal activity. Faults of N-S system occur in two areas: May Khoan-Khao Lien-Deo Giao, and Coc Vuong-Dong Khuong. These sublongitudinal faults are cut in many places by faults of NE system. Faults of NE system occur pervasively over the Bo Cu area. They are subdivided into two groups: northwestern group and southeastern group. These faults cut both those of NW system and N-S system. Along these faults, intense deformation and shearing are observed.

Da Mai area is situated on the northern wing of the Bo Cu anticline. The general strike of strata is WNW-ESE with gentle to moderate N-dip.

The geology is composed of Mo Dong, Than Sa, Bac Bun and Mia Le Formations. The Mo Dong Formation crops out widely in the Da Mai area. It consists mainly of sandstone (C_{md2}). Alternating beds of sandstone and schist (C_{md1}) occur at the upper part of the formation in the Da Mai area. A local anticline with an axis of WNW-ESE was observed along the ridge of Da Mai creek. The Than Sa Formation – the Lower Member – occurs in the eastern part of the area. The Bac Bun and Mia Le Formations occur at the northeastern corner of the area. Gold-bearing quartz veins are hosted by the Mo Dong and Than Sa Formations.

A series of tectonic faults run from east to west along S. Ca at the northern part of the Da Mai area. The southern side of the fault was uplifted in this area. A local fault of NNE-SSW system was observed in the western part of this area.

(4) Mineralization

Gold-bearing quartz veins are developed in Da Mai, Gang, Cay Thi, Ngan Me and Bai Vang. These were regarded to be a mesothermal gold deposit. The occurrence of gold-bearing quartz veins in the Da Mai and Ngan Me (including Bai Vang) areas was surveyed in detail in the second phase.

Quartz veins are hosted mainly by sandstone and schist of the Mo Dong Formation, and partly -- those in the eastern part of the Da Mai area and in the southwestern part of the Ngan Me area -- by sandstone and schist of the Than Sa Formation. Quartz veins generally show E-W, WNW-ESE and ENE-WSW trend. Two major groups were distinguished in their dips: south dip and north dip. The width of each quartz vein changes variously, ranging from a few centimeters up to 3 m. Tiny gold grains were observed by naked eye in some localities. Gold is sometimes accompanied by sulfide minerals; pyrite and arsenopyrite are the two most common minerals. Strong silicification, chloritization and weak sericitization were commonly observed in the host rocks beside the quartz veins. The major occurrences of gold-bearing quartz veins are described in the following sections with some representative sketches.

More than 500 quartz veins of outcrops and in the mining pits/adits were surveyed in the second phase. Additional 500 vein data surveyed by GSV in 1989 to 1991 were analyzed this time. Trends of quartz veins were statistically investigated using the Schumidt's stereo net. The Schumidt's stereo net projections of quartz veins are illustrated in figures in the second phase report. Sketches of the representative veins are shown in figures in the second phase report. Major results of ore assays are shown in Table 2-2-1. The results of mineralogical analyses of ore, gangue and alteration minerals are shown in the summary tables. The results of the fluid inclusion studies are explained in a section below.

Hundreds of quartz vein outcrops and people's mining pits/adits are distributed on the flank and up to the top of the ridge (about 400 m above sea level) in the Da Mai area. It is approximately 7 km (E-W) by 2 km (N-S) in area. Gold-bearing quartz veins in the Da Mai area are hosted by sandstone, shale and sericite schist of the Mo Dong and Than Sa Formations. The width of veins ranges from a few centimeters to 2 m. The major trend of vein systems is E-W to ENE. Most of the veins dip steeply to S with some exceptions of N-dip. Gold is generally accompanied by a small amount of sulfide minerals. Arsenopyrite and pyrite are the two most common sulfide minerals; chalcopyrite and covelline were occasionally found in bonanzas of gold. The vein quartz in the Da Mai area is characterized by grayish color. It is probably caused by the sulfide content. The host rock beside the vein is slightly altered. The major alteration minerals are quartz, sericite and chlorite.

The local people's mining activity in the Da Mai area has a relatively long history among the other areas in the Bo Cu area. The Division No. 1 of GSV started survey in 1988, and saw several mining pits/adits dug at a creek (Da Mai creek). The people's activity may be looked back to 1985 or earlier. In 1989 and 1990, the Division No. 1 made trenching survey in this area, and found some new quartz veins. Ore reserves estimated by the Division at that time were 500 kg Au for hard rock gold (shallow part) and 600 kg Au for alluvial gold (along S. Ca).

The major prospects in the Da Mai area are: Da Mai-Khe Dui, NE of N. Bo Cu, and Khe Ma-S. Khuon Da. The distribution of gold-bearing quartz veins is shown in Fig. 2-2-2. The details of the occurrences of quartz veins in the major prospects are described below.

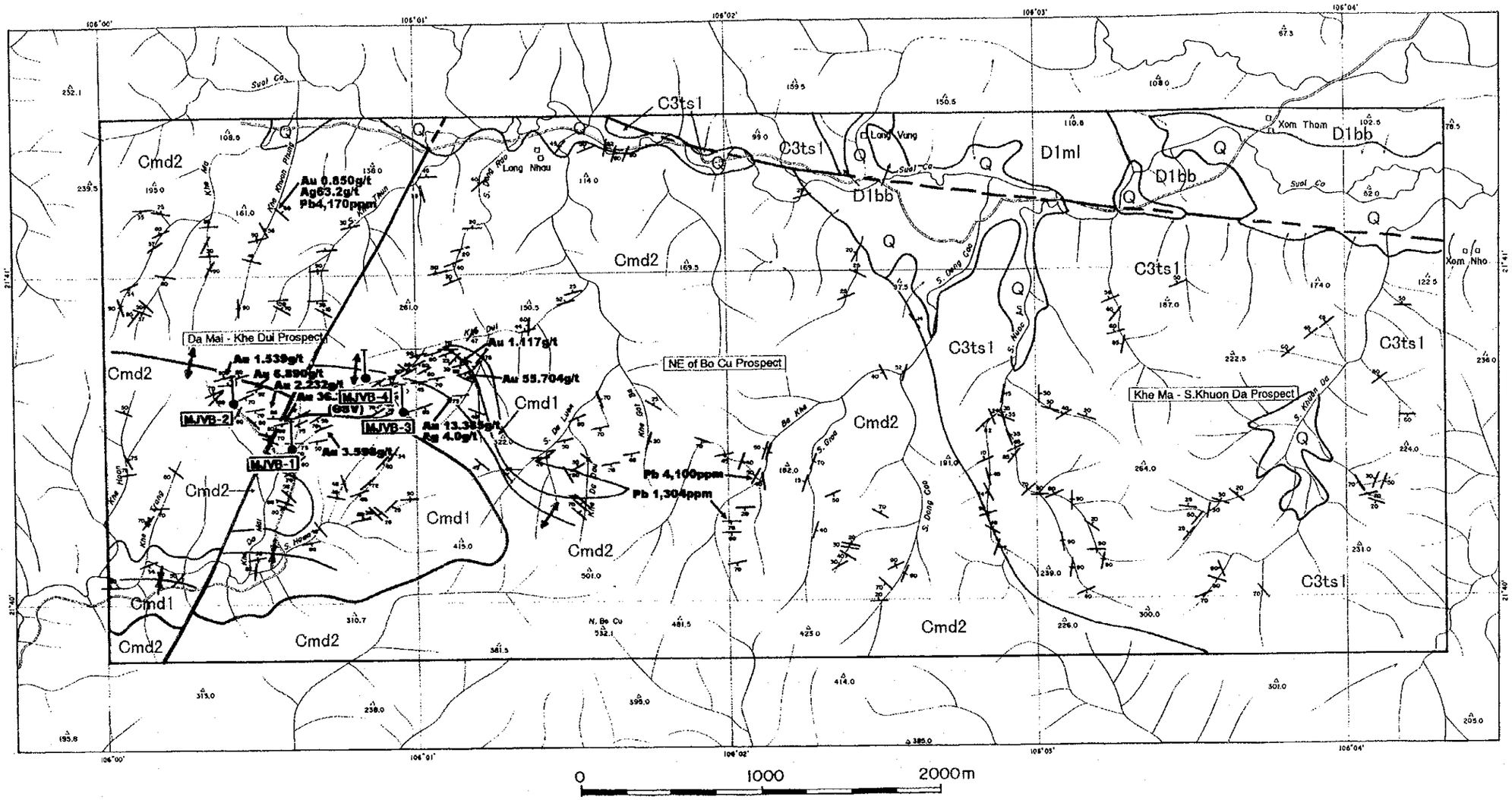
Da Mai-Khe Dui Prospect

Gold-bearing quartz veins occur at several localities -- Da Mai creek, West Da Mai creek, Khe Dui creek, Goc Sen, Da Luon creek, Khe Thun creek, North Da Mai, and Dong Rao creek -- in the Da Mai-Khe Dui prospect. The major groups of gold-bearing quartz veins are subdivided into three: Da Mai creek veins, Khe Dui creek veins, and West Da Mai creek veins.

Da Mai creek is the oldest mining place in the Bo Cu area. More than ten old adits are distributed along the creek. The trend of veins is mostly E-W to ENE-WSW with steep S-dip. Quartz veins are hosted mainly by an alternating bed of sericite schist and sandstone. According to the Division No. 1 data, gold assays up to 36.38 g/t Au at 90 cm in width were returned. Two kinds of quartz were observed: white quartz and gray to light gray quartz. Sulfide minerals are relatively little in veins in this place.

Along Khe Dui creek (a branch of S. Ca), many gold anomalies were detected during the geochemical survey in the first phase. More than ten shafts, adits and prospecting pits are distributed along the upstream of Khe Dui creek. The quartz veins in the Khe Dui prospect are arranged in the E-W direction. They generally dip to S at 50 degrees. Some of the veins strike NE-SW. The host rocks are sandstone and schist. Sheared, argillized and sulfide disseminated zones were sometimes observed along the veins. The vein quartz sometimes shows gray color. Veins in Khe Dui creek usually contain a small amount of sulfide minerals. Visible gold was frequently observed in quartz veins in Khe Dui creek. Assay results up to 55.704 g/t Au at 8 cm (A264A) and 13.385 g/t Au and 4.0 g/t Ag at 45 cm (A263A) were obtained through the detailed survey this phase.

Several adits were dug on the slope of West Da Mai creek near the ridge. The trend of veins is E-W to ENE-WSW in this creek. They dip nearly vertical. Some veins dip to N. Quartz veins up to 1 m in width were found there. Quartz of the veins generally shows gray color. They are hosted by sandstone and schist. The host rocks adjacent to veins were sheared. Assay results up to 6.890 g/t Au at 8 cm (A244A) were returned from samples in this place.



LEGEND

Quaternary	Q	Alluvial Deposits
Devonian	D1ml	Mia Le Formation
	D1bb	Bac Bun Formation
Cambrian	C3ts1	Lower Than Sa Formation
	Cmd2	Mo Dong Formation 2. Mainly composed of sandstone
	Cmd1	1. Alternation of schist & sandstone

Fault

Anticlinal Axis

Synclinal Axis

Drill Hole

Gold-bearing Quartz Vein

Fig. 2-2-2 Distribution of Gold-Bearing Quartz Veins in the Da Mai Area

From Goc Sen to the east, several shafts and pits were dug at and near the top of the dividing ridge whose altitude is about 400 m above sea level. Quartz veins trend nearly E-W with a steep S dip. Veins occur until Da Luon creek.

In Da Luon, Dat Dau and Gat Ba, which are branch creeks of S. Ca and are located about 1.5 km east of Da Mai creek, quartz veins show E-W trend with dips of 20 to 60 degrees S and NW-SE to NNW-SSE trend with dips of 40 to 70 degrees E. The widths of veins range from a few centimeters up to 1.9 m. The widths decrease to the east. Veins are hosted by gray sericite schist and shale (weakly schistose) of the Mo Dong Formation. Local people's mining adits and shafts are distributed in these creeks.

Significant amounts of quartz veins occur at Khe Thun (North Da Mai), Khe Ma and Khe Khuon Phung, which are branches of S. Ca and are located about 1 km north of Da Mai creek. They show mainly E-W trend with dips 20 to 40 degrees both S and N. There are few which show NW trend. The width changes from 10 cm to 1 m. They are hosted by sericite schist and sandstone of the Mo Dong Formation. Sulfide rich quartz veins were found in Khe Khuon Phung (0.850 g/t Au, 63.2 g/t Ag, 12.22 % Fe at 40 cm, B031A). People's mining activity is relatively scarce in this place.

From Dong Rao creek to the mainstream S. Ca situated 0.5 km north of Khe Dui, tens of quartz veins occur in gray schist, sandstone and siltstone of the Mo Dong Formation. Quartz veins show E-W to ENE-WSW trend with dips of 20 to 50 degrees S and N. Some veins show NNE-SSW to NE-SW trend. People's mining activity has not been observed.

Results of stereo net analysis showed two significant concentrations of vein trends: E-W trend with dips of 53° S and E-W trend with dips of 40° N.

Sulfide minerals observed under the microscope in the Da Mai-Khe Dui area are: pyrite, arsenopyrite, pyrrhotite, chalcopyrite, covelline, chalcocite, tetrahedrite, sphalerite, galena, scorodite, and limonite. Native gold of up to 0.3 mm in diameter was observed in some samples from Khe Dui (A264P). Native gold frequently occurs as free gold in quartz veins. It also occurs in a form accompanied by sulfide minerals such as arsenopyrite. Native gold contained in scorodite like a micro-vein was found in a sample (A264P).

NE of N. Bo Cu Prospect

This prospect (approximately 2.5 km in E-W by 2.0 km in N-S) is located at the northeast of N. Bo Cu, which is covered by several branch creeks of S. Ca -- Ba Khe, S. Giao, S. Dong Cao, and S. Nuoc An. Quartz veins are hosted mainly by gray schist and sandstone of the Mo Dong Formation. Some of them in the northeastern part of the prospect are hosted by sandstone and schist of the Than Sa Formation (of the Lower Member). Two major trends of quartz veins were distinguished: E-W trend with 73° S , and E-W trend with 20° N. Other trends such as NW-SE, NNW-SSE, NE-SW and NNE-SSW were also found locally. Veins of the E-W trend occur mainly in the central to the western parts of the prospect near Da Luon. Whereas those of the NW-SE, NNW-SSE, NE-SW and NNE-SSW

trends occur mainly in the eastern part of the prospect. The widths of veins are from a few centimeters to 1 m. They contain a small amount of sulfide minerals such as pyrite. A few local people's adits exist at Ba Khe (different creek from Ba Khe in the Ngan Me area).

Khe Ma-S. Khuon Da Prospect

This prospect is situated in the most eastern part of the Da Mai area. Tens of quartz veins, though narrow in width, occur along Khe Ma (different from Khe Ma in the Da Mai-Khe Dui prospect) and S. Khuon Da, both is branches of S. Ca. Quartz veins are hosted by sandstone, schist and shale of the Than Sa Formation (of the Lower Member). Various trends were recognized: WNW-ESE to NW-SE with dips of 50 to 70 degrees to S, NE-SW to ENE-WSW with dips of 40 to 50 degrees to N, and others. They are concentrated in the ENE-WSW trend with 52° N dip on the stereo net. Veins in the southern part mainly show WNW-ESE to NW-SE trend. Whereas those in the northern part show NE-SW to ENE-WSW trend. No people's mining activity was observed except for alluvial gold.

2-2-4 Fluid Inclusion Studies

(1) Methodology

Quartz chips were collected, and provided for fluid inclusion studies. Eleven quartz chips were sampled in the first phase in the semi-detailed survey area. The breakdown is: four from the Da Mai area, three from the Gang area, and four from the Ngan Me area. All samples were taken from quartz veins. Homogenization temperature was measured.

Thirty quartz chips were collected, and provided for fluid inclusion studies in total in the second phase. The breakdown is: nineteen from the Da Mai area, and eleven from the Ngan Me area. All samples were taken from quartz veins. Homogenization temperature and salinity were measured.

The observation of quartz chips was made in the field according to the description criteria usually required in the field survey. The observation of fluid inclusions under the microscope was undertaken in the laboratory. The morphological observation of fluid inclusions is understood to be important for estimating an environment under which fluid inclusions and their host minerals were formed. Therefore, it is necessary to work very carefully before going into the thermometric measurement. General process of the microscopic observation consisted of the following contents:

- Distinction between primary/pseudosecondary inclusions and secondary ones
- Observation of size, shapes and surface smoothness

•Estimation of filling degrees (approximate liquid to gas volumetric ratios of inclusions)

•Identification of solid crystal in inclusions when exists

•Search for any evidence indicating fluid boiling phenomena

Most of the important samples were micro-photographed on the microscopic observation.

Measurements of homogenization temperature of liquid-gas and polyphase inclusions were made with the heating-stage under the microscope. Several to forty measurements for each sample were made, and the results were statistically processed. An arithmetic mean was adopted as the representative value for each sample. The standard deviation among the values of homogenization temperature in each sample was checked. The results of homogenization temperature measurements were plotted on the map and examined geologically.

Measurements of salinity of liquid-gas and polyphase inclusions were made with the freezing-stage under the microscope in the second phase.

(2) Results of Studies

Measurements of homogenization temperature were relatively difficult because most of the fluid inclusions in quartz chips were fine. The average diameter is 10 microns. Fluid inclusions of larger than 30 microns in diameter were seldom found. As a result of this fine nature of fluid inclusions, the homogenization temperature may indicate relatively lower than the actual formation temperature of the main stage of gold mineralization. The results of the measurements are listed in Table 2-2-2 together with those in other areas. The distribution of the homogenization temperatures is summarized in Fig. 2-2-3. (This histogram shows the overall results of homogenization temperature measurements: both of the surface samples and drill core samples, and not only in the Da Mai area but also in the Ngan Me and Gang areas.)

Morphology of Fluid Inclusion

In the first phase, the number of fluid inclusions which were investigated under the microscope was 458 in total. More than eighty percents of them are liquid-rich two-phase inclusions. Gas-rich two-phase inclusions are less than 20 % of them. The actual percentage of gas inclusions may probably be much less. The possibility of miss-identification still exists despite the careful observation. Because fluid inclusions are three-dimensional objects which are being observed in only two dimensions, inclusions having consistent liquid-to-gas ratios may appear to have variable phase ratios. This result may indicate that the boiling of fluid has occurred locally during the formation of quartz vein.

Table 2-2-2 Summary of Fluid inclusion Studies (1)

Ser. No.	Sample No.	Locality	Number of Measured Inclusions	Homogenization Temperature			Salinity		Kind of Inclusions (Liquid-rich/Gas-rich/Polyphase)	Remarks
				Minimum (℃)	Maximum (℃)	Mean (℃)	(1) (NaCl eq.%)	(2) (NaCl eq.%)		
		Da Mai Area								Native gold observed (microscope)
1	D444F	Goc Sen	46	140	254	203			L+G	--
2	D448F	Khe Dui	25	148	212	176			L	--
3	D453F	Da Mai	12	140	191	159			L	--
4	D455F	Da Mai	29	142	259	186			L+G	--
5	A002F	Da Luon	31	152	377	270	5.5		L+G+P	L-gray Qz vein, Py diss.
6	A005F	Da Luon	33	121	292	174	1.2	4.2	L+G+P	Qz vein.
7	A009F	Dat Dau	3	151	229	190			L+G	Qz vein.
8	A034F	Lang Vang	6	157	249	210			L+G+P	L-gray Qz vein.
9	A090F	Cuc Tac	4	193	235	214			L+G	White/L-gray Qz vein, Py diss.
10	B010F	Khe Dui	3	227	251	239			L+G	White/L-gray Qz vein, Py diss.
11	B011F	Khe Dui	3	195	235	215			L+G	WhiteQz vein, Limo diss.
12	B012F	Khe Dui	3	231	274	253			L+G	WhiteQz vein, Limo diss.
13	B013F	Khe Dui	23	250	348	296	5.1		L+G	Qz vein.
14	B016F	Khe Dui	4	177	245	211			L+G	WhiteQz vein, Limo diss.
15	B017F	Khe Dui	36	223	356	266			L+G	White/L-gray Qz vein, Limo diss.
16	B023F	Khe Ma	29	226	332	290	8.7		L+G	L-gray Qz vein.
17	B033F	Khuon Phung	6	211	277	238			L+G+P	White/L-gray Qz vein, Limo diss.
18	B084F	S. Hoan	20	141	315	210			L+G	L-gray Qz vein, Limo diss.
19	B090F	S. Hoan	5	214	222	218			L+G+P	White Qz vein, Py diss.
		Ngan Me Area								
20	A255F	Ba Khe	51	148	243	196			L+G	Native gold observed (microscope)
21	D408F	Ngan Me	56	148	251	190			L+G	--
22	D419F	Ngan Me	35	142	224	185			L+G	--
23	D420F	Ngan Me	53	142	246	198			L+G (CO_2)	--
24	A120F	Ho Mai	2	191	308	250	Too small to measure		L	White/L-gray Qz vein.
25	A123F	Ho Mai	30	196	350	299	5.2	5.7	L+G+P	White Qz vein.
26	A131F	Ho Mai	5	167	245	212			L+G	White Qz vein, Py diss.
27	A143F	Na Hon	4	164	215	190			L+G	Qz vein.
28	A150F	Na Hon	39	147	316	232			L+G	White Qz vein.
29	B096F	Ba Khe	3	191	225	208			L+P	White/L-gray Qz vein, Py diss.
30	B098F	Ba Khe	4	162	253	215			L+P	White/L-gray Qz vein, Py diss.
31	B104F	Ba Khe	13	186	325	217			L+G	White/L-gray Qz vein, Py diss.
32	B110F	Ba Khe	38	194	345	267			L+G	L-gray Qz vein, Py diss.
		Gang Area								
33	D375F	Khe Hoac	46	140	272	219			L+G	Two groups of Homogenization Temp.
34	D376F	Khe Hoac	58	161	302	234			L+P	Two groups of Homogenization Temp.
35	D391F	Khe Gang	47	158	300	239			L+G	Two groups of Homogenization Temp.

Table 2-2-2 Summary of Fluid inclusion Studies (2)

Ser. No.	Sample No.	Drill Hole No. & Depth (m)	Number of Measured Inclusions	Homogenization Temperature Minimum (℃)	Homogenization Temperature Maximum (℃)	Homogenization Temperature Mean (℃)	Salinity (1) (NaCl eq.%)	Salinity (2) (NaCl eq.%)	Kind of Inclusions (Liquid-rich/Gas-rich/Polyphase)	Remarks
		Da Mai Area								
		MJVB-1								
1	102F	17.45	6	165	285	218			L+G	White Qz network
2	106F	98.62	7	152	295	213			L+G+P	White Qz vein/breccia, Py diss, visible Au(?)
3	110F	105.70	8	165	260	224			L+G+P	White Qz vein/breccia, Py diss.
4	113F	108.00	8	180	340	265			L+G	White Qz vein/breccia, Py diss, visible Au.
5	117F	129.85	7	180	305	241			L+G+P	White Qz vein/veintet.
6	119F	137.25	29	152	282	207	4.7		L+G	White Qz vein/veinlet.
7	122F	155.46	27	165	295	219	4.1	5.7	L+G+P	L-gray Qz vein/veinlet, Py diss.
		MJVB-2								
8	208F	135.20	3	145	185	0			L	L-gray Qz vein/network, Py, As diss.
9	213F	148.68	8	156	292	167			L+G+P	L-gray Qz vein/network, Py, As diss, visible Au.
		MJVB-3								
10	305F	79.44	35	182	386	282	5.7	4.6	L+G+P	White/L-gray Qz vein, Limo diss.
11	313F	147.77	15	209	244	225			L+G	L-gray Qz-Cal-Chl netwk zone, Py diss (m).
12	318F	230.96	27	146	278	201			L+G	White Qz-Cal-Chl vein, Py & As diss (s).
		MJVB-4								
13	402F	40.21	23	143	340	205	1.7	1.6	L+G+P	L-gray Qz-Cal vein, Py diss (w).
14	418F	146.33	42	186	298	245	4.3	2.9	L+G+P	White Qz-Cal veinlet/netwk zone, Py & As diss (s).
15	421F	153.29	26	180	299	234			L+G	White Qz-Chl veinlet/netwk zone.
16	429F	256.35	5	208	237	223			L+G	L-gray Qz-Cal vein, Py & Gn diss (w).
		Ngan Me Area								
		MJVB-5								
17	507F	102.05	17	142	192	173			L+G	L-gray Qz vein, Py diss.
18	521F	263.43	41	177	326	257	6.3	4.9	L+G+P	L-gray Qz veinlets/networks with Cal and Chl, Py diss.
		MJVB-6								
19	617F	54.80	12	160	198	182			L+G	L-gray Qz vein.

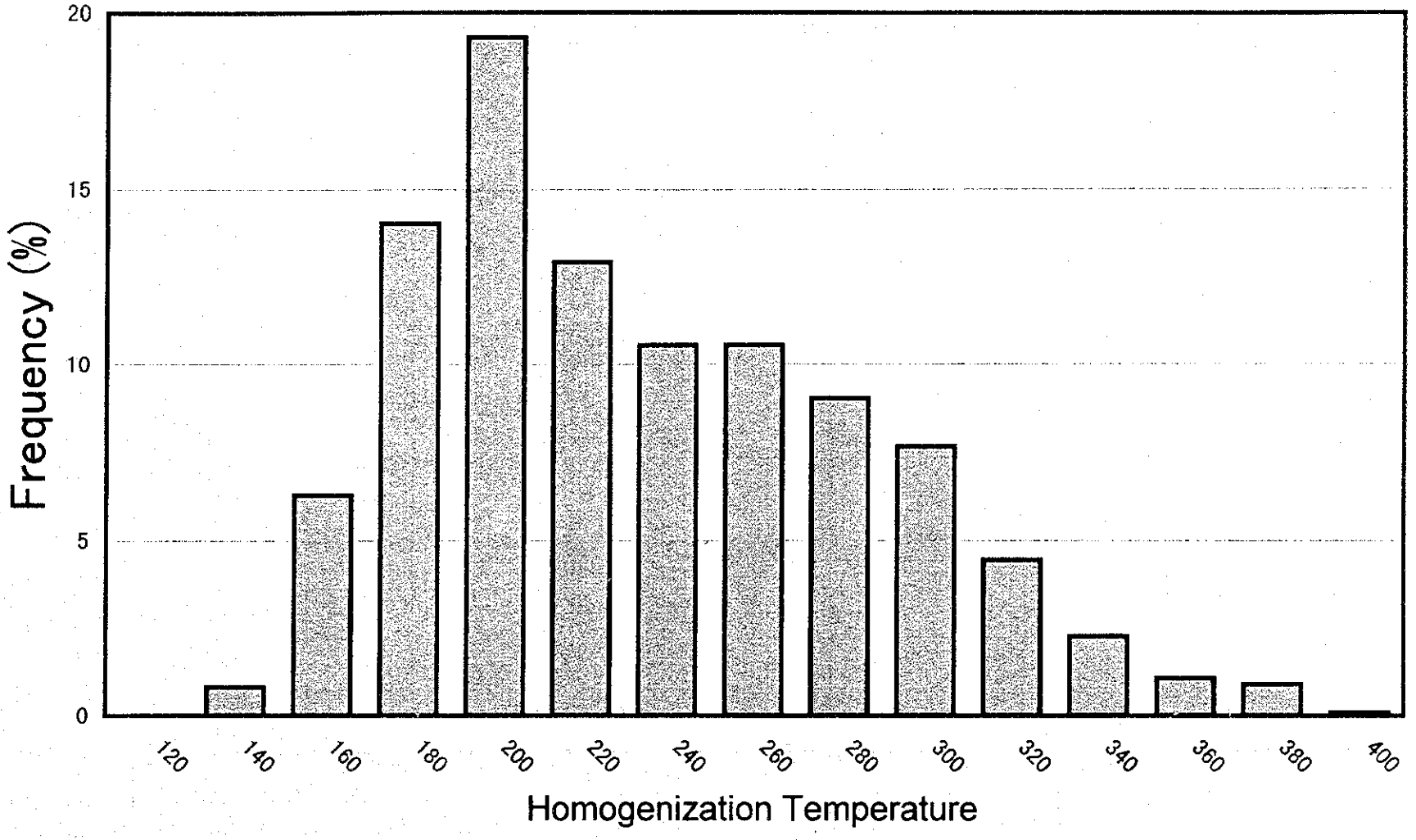


Fig. 2-2-3 Histogram of Homogenization Temperature of Fluid Inclusions

CO_2 gas was detected in the vapor part of some two-phase inclusion in one sample (D420F) taken from the Ngan Me area.

A polyphase inclusion was found in one sample (D376F). It came from a quartz sample in Khe Hoac. Halite was distinguished as a daughter mineral. From the occurrence of halite in inclusions, the salinity of this liquid is estimated to be considerably high.

In the second phase, the number of fluid inclusions which were investigated under the microscope was 347. More than eighty percents of them are liquid-rich two-phase inclusions. Gas-rich two-phase inclusions are less than 20 % of them. The actual percentage of gas inclusions may probably be much less. This result may indicate that the boiling of fluid has occurred locally during the formation of quartz vein.

Polyphase inclusions were found in 8 samples. They were collected from quartz veins in both Da Mai and Ngan Me areas. Halite was distinguished as a daughter mineral. From the occurrence of halite in inclusions, the salinity of this liquid is estimated to be considerably high.

Homogenization Temperature

In the first phase, values of homogenization temperature of each fluid inclusion were distributed from 140°C up to 302°C. Most of them fall into a range of 168° ~ 240°C. Mean values of homogenization temperature of samples which showed a significant value of gold range from 159°C to 239°C. The values of homogenization temperature could be classified into two groups from the distribution on the frequency histogram. One group has a mean value of about 185°C, and ranges from 140°C to about 230°C. Another has a mean of 260°C with a range of 230°C to 302°C.

The comparison of features of fluid inclusions among three areas was checked as follows:

Da Mai area: The mean temperature of each sample ranging from 175°C to 200°C. Mainly composed of very fine liquid-rich inclusions.

Gang area: Relatively high mean temperature. Two groups of temperature values were clearly observed. The lower one is 180° to 190°C, and the higher one 255° to 280°C in the mean temperature. Some consist of liquid-rich inclusions. The mixture of liquid-rich and gas-rich inclusions, however, were found in anther sample. A polyphase inclusion was discovered in one sample.

Ngan Me area: The mean temperature is concentrated at around 190°C (180° to 200°C). The inclusions in this area are mostly liquid-rich plus some gas-rich. An inclusion with CO_2 gas was found in one sample in this area.

Although samples checked by the fluid inclusion studies were limited, a significant difference of homogenization temperatures were distinguished in fluid inclusions among these areas. Some samples from Khe Hoac and Khe Gang in the Gang area showed distinctive higher range of homogenization temperature values together with the lower range.

In the second phase, values of homogenization temperature of each fluid inclusion were distributed from 121°C up to 377°C. Most of them fall into a range of 140° ~ 340°C. The values of homogenization temperature were classified into two groups from the distribution on the frequency histogram. One group has a peak value of about 190°C, and ranges from 121°C to about 220°C. Another has a peak of 290°C with a range of 220°C to 377°C.

The comparison of features of fluid inclusions between Da Mai and Ngan Me areas was checked.

Da Mai area: The mean temperature of each sample ranging from 174°C to 296°C. Mainly composed of fine liquid-rich plus gas-rich inclusions. Five polyphase fluid inclusions were found.

Ngan Me area: The mean temperature ranges from 190°C to 299°C. It shows slightly narrower range but almost same as in the Da Mai area. The inclusions in this area are mostly liquid-rich. Some polyphase inclusions coexisting with liquid-rich ones were observed in 3 samples.

Although samples checked by the fluid inclusion studies were limited, the difference of homogenization temperatures between two areas was not so significant.

Salinity

Samples for the measurement of freezing temperature were selected from quartz chips of which homogenization temperature was measured in the second phase. Most of fluid inclusions were too small for the freezing stage. Seven measurements on salinity for 5 fluid inclusions were carried out. Liquid-rich inclusions of which salinity was measured were coincided with those in which polyphase inclusions were observed. Such samples tend to show high homogenization temperatures in the higher range of the temperature distribution. The brake-down of samples on salinity measurement are: four from the Da Mai area, and one from the Ngan Me area.

Salinity calculated from the freezing temperatures of fluid inclusions ranges from 1.2 to 8.7 wt. % NaCl equivalent. The arithmetic mean of seven salinity values is 5.1 wt. %.

2-3 Rock-Chip Geochemical Survey

2-3-1 Sampling and Chemical Analysis

Rock-chip geochemical survey was carried out in the Da Mai and Ngan Me areas in the second phase for the purpose of defining hidden mineralized zones which would otherwise be undetected by geological survey, as well as for clarifying the extensions of mineral occurrences encountered through the geological traverse.

Quartz vein and altered rock samples were collected from every outcrop and some old pits/adits in the survey area. The number of rock-chip samples collected during the survey was 314, which corresponded to a sampling density of approximately eight samples in one square kilometer. In addition to these rock-chip samples, a total of 70 ore assay samples were collected from some prospecting pits/trenches and people's adits in the second phase. The results of assays were examined together with the geochemical results. The samples of the rock-chip geochemistry were analyzed at the Analytical and Experimental Center, Department of Geology and Minerals of Vietnam for 8 elements: Au, Ag, Cu, Pb, Zn, As, Sb, and Hg. The methods of analysis and limits of detection are shown in a table in the second phase report.

2-3-2 Statistical Data Processing

The distribution of geochemical data of some elements tends to show a close approximation to the logarithmic normal distribution in most cases. After the mode of distribution being examined, the common logarithmic conversion of the respective analytical values was adopted, if necessary, in the statistical data processing. When an analytical value was less than the detection limit, a value half of the lower limit was substituted in the calculation.

At first, statistical properties of geochemical data were checked. Basic statistical figures were calculated. Distribution histograms of each element were drawn out. Correlation coefficients among 8 elements were examined.

Then the selection of threshold values for anomalies was made. The cumulative frequency distribution of each element which showed the logarithmic normal distribution was plotted on the logarithmic probability graph using computer. If an element displayed any significant curvature, then the threshold was determined from the corresponding value on the curve. If any specific curvature was not recognized on the curve, then the threshold was calculated by the value of twice the standard deviation added to the mean of the element. The thresholds of Au, Ag, Cu, Pb, Zn, As and Sb were obtained on the logarithmic probability graphs. While that of Hg was determined by the statistical calculation mentioned above.

A series of maps showing geochemical anomalies of rock-chips for each element was produced. Values of each sample were expressed by one of two kinds of symbols (anomalous or non-anomalous) on the map. Geochemical anomalies for each element were cross-checked on the maps. The results of geological survey, especially those of the distribution of mineralized and alteration zones, were also referred.

Gold mineralization and associated alteration were presented by the distribution of most of the analyzed elements in the rock-chip geochemistry. The Au anomalies of rock-chips were well correlated with the occurrences of gold mineralized zones, of course. The distributions of Pb and As significantly corresponded to the mineralized zones. The distributions of the other elements such as Cu, Zn and Sb also corresponded to the gold mineralized zones to some extent. The kind of elements and degree of these correspondences varied from prospect to prospect. The association of these geochemical elements was explained by the mineral assemblage of ores. Consequently, these elements were thought to be good indicators of gold mineralization in this area.

These results were integrated together, and several significant anomalous zones were outlined. Several significant potential mineralized areas thus chosen are described in the next section. The distribution of geochemical anomalies was drawn by computer. Major analytical results of rock-chip samples are shown in Table 2-2-3. The distribution of major rock-chip geochemical anomalies is shown in Fig. 2-2-4.

2-3-3 Anomalies of Rock-Chip Geochemistry

The followings are the major anomalies detected through the rock-chip geochemistry in the Da Mai area in the second phase:

Da Mai-Khe Dui prospect: Numerous Au anomalies and several anomalies of Cu, Pb, Zn and As of rock-chips were found in the Da Mai-Khe Dui prospect. Strong and concentrated anomalies of Au were detected at Da Mai, West Da Mai and Khe Dui. Some Cu anomalies (up to 162 ppm), Pb anomalies (up to 299 ppm) and As anomalies were associated with Au anomalies at West Da Mai, Khe Dui and Da Mai respectively. Au anomalies occur sporadically at the surrounding locations such as Goc Sen, Da Luon, North Da Mai and Khe Thun. At Khuon Phung of North Da Mai, distinctive Au, Ag, Pb and Zn anomalous values were obtained.

Northeast of N. Bo Cu prospect: Significant Au anomalies (up to 301 ppb) of rock-chips were detected at S. Nuoc An in the Northeast N. Bo Cu prospect. A few anomalies of Pb occurs at Lang Vang (Ba Khe) in the Northeast N. Bo Cu prospect.

Khe Ma-Khuon Da prospect: Sporadic Au anomalies were detected at Khe Ma and S. Khuon Da in the Khe Ma-Khuon Da prospect.

Table 2-2-3 Major Analytical Results of Rock-Chip Geochemical Samples in the Da Mai Area

Ser. No.	Sample No.	Width (cm)	Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	As (ppm)	Sb (ppm)	Hg (ppm)	Location
1	A001	130	4	0.05	58	47	236	74	11	<0.03	Da Luon
2	A006	70	49	0.35	53	69	163	66	11	<0.03	Da Luon
3	A008	60	3	3.40	56	38	137	44	25	<0.03	Da Luon
4	A036	70	12	0.08	99	57	52	208	8	<0.03	Lang Vang
5	A044	10	7	0.05	18	13	18	169	8	<0.03	Lang Vang
6	A059	150	29	0.13	20	41	19	140	6	<0.03	Dong Cao
7	A092	--	27	0.11	29	17	16	434	2	<0.03	Cuc Tac
8	A097	5	106	0.08	39	66	29	192	11	<0.03	Cuc Tac
9	A100	10	18	0.64	78	25	51	53	22	<0.03	Cuc Tac
10	A102	15	179	0.12	162	6	9	7	4	<0.03	Cuc Tac
11	B005	15	47	0.10	29	10	14	198	7	<0.03	Khe Dui
12	B008	20	33	0.07	34	14	44	21	2	<0.03	Khe Dui
13	B009	100	2	0.25	32	277	59	24	7	<0.03	Khe Dui
14	B020	10	9	0.70	101	299	65	23	2	<0.03	Khe Ma
15	B024	20	19	0.31	30	36	25	156	6	<0.03	Khe Ma
16	B027	50	24	0.07	49	153	145	2	9	<0.03	Khe Ma
17	B030	20	13	0.10	40	119	57	18	9	<0.03	Khe Ma
18	B035	120	49	2.79	68	196	118	567	16	<0.03	Khe Ca
19	B040	15	301	<0.04	30	31	48	11	6	<0.03	Nuoc An
20	B048	40	53	<0.04	37	26	67	1	1	<0.03	Nuoc An
21	B055	15	36	0.04	31	30	73	7	15	<0.03	Dong Cao
22	B072	20	52	0.07	55	27	52	25	5	<0.03	S. Hoan
23	B075	40	32	0.04	25	14	35	13	6	<0.03	S. Hoan
24	B078	100	223	<0.04	58	19	75	<1	10	<0.03	S. Hoan
25	B081	7	59	0.22	45	268	51	14	2	<0.03	S. Hoan
26	B083	15	41	0.21	63	17	24	38	4	<0.03	S. Hoan