APPENDICES

PART I

Geological Survey

LIST OF APPENDICES

A 1 - 1. List of rock samples

Geological Index

Sedimentary rocks

Quaternary (gravel & sand)	QU
Chonta Group	CH
Oriente Group	OR
Sarayaquillo Formation	SA
Pucara Group	PU
Mitu Group	MI

Igneous rocks

Tertiary	Volcanic Breccia	TV
	Rhyolite & Dacite	TR
	Quartz porphyry & Granite porphyry	MP
Cretaceous Granite		CG
Jurassic Diorite Complex		MD
Permian ~ Triassic	Granite & Granodiorite	PG
	Granodiorite Complex	PC

Sample No.	Field No.	Location	Geological unit	Rock name	Thin section	Polished section	Chemical analysis (ore)	X-ray	Dating	Chemical analysis (whole rock)	Fossil	Minor element analysis	Geochemical analysis
686	A301	8	PU	Limestone	○								△
687	A302	8	PU	Dolomitic Limestone				○					△
688	A306	8	PU	Dolomite								○	△
689	A308	8	PU	Limestone		○						○	△
690	A309	8	PU	Dolomite		○		○				○	△
691	A315	10	PU	Dolomitic Limestone								○	△
692	A318	10	CG	Granite	○								
693	A320	10	PU	Dolomite				○					△
694	A321	10	PU	Dolomitic Limestone								○	△
695	A323	6	PU	Limestone	○						○	○	△
696	A325	6	PU	Limestone								○	△
697	A326	6	PU	Dolomite								○	△
698	A327	6	PU	Dolomite				○				○	△
699	A328	6	PU	Limestone								○	△
700	A333	20	MP	Quartz porphyry	○								
701	A335	20	PU	Andesitic Tuff	○								
702	A340	20	PU	Limestone	○						○	○	△
703	A403	23	PU	Limestone								○	△
704	A406	23	PU	Dolomite								○	△
705	A414	23	PU	Dolomite	○							○	△
706	A420	23	PU	Dolomitic Limestone								○	△
707	A428	23	PU	Limestone								○	△
708	A429	23	PU	Dolomitic Limestone								○	△
709	C301	4	PU	Silicified Limestone				○					△

Sample No.	Field No.	Location	Geological unit	Rock name	Thin section	Polished section	Chemical analysis (ore)	X-ray	Dating	Chemical analysis (whole rock)	Fossil	Minor element analysis	Geochemical analysis
710	C306	4	PU	Silicified Limestone				○					△
711	C307	4	PU	Silicified Limestone				○					△
712	C308	4	PU	Dolomitic Limestone		○						○	△
713	C310	4	PU	Dolomitic Limestone								○	△
714	C311	7	PU	Micritic Limestone								○	△
715	C315	7	PU	Dolomite								○	△
716	C318	7	PU	Dolomitic Limestone								○	△
717	C322	22	PU	Calcareous Sandstone	○						○		
718	C323	22	PU	Calcareous Sandstone	○						○		
719	C329	11	PU	Dolomitic Limestone								○	△
720	C340	11	PU	Sparitic Limestone								○	△
721	C347	11	PU	Quartzose Sandstone				○					△
722	C354	11	PU	Dolomite								○	△
723	C361	11	PU	Shale-Sandstone				○					△
724	C401	9	PU	Dolomitic Limestone								○	△
725	C404	4	PU	Silicified Limestone				○				○	△
726	C409	4	PU	Dolomite								○	△
727	C410	4	PU	Biomicritic Limestone								○	△
728	C411	4	MP	Quartz porphyry	○				○	○			
729	C413	21	PU	Sparitic Limestone			○						
730	C414	21	PU	Limestone			○						
731	C416	21	PU	Lead Ore		○	○						
732	C503	23	PU	Dolomite								○	△
733	C510	23	PU	Micritic Limestone								○	△

Sample No.	Field No.	Location	Geological unit	Rock name	Thin section	Polished section	Chemical analysis (ore)	X-ray	Dating	Chemical analysis (whole rock)	Fossil	Minor element analysis	Geochemical analysis
734	C523	23	PU	Dolomite				○					△
735	C526	23	PU	Dolomitic Limestone				○					△
736	C538	23	PU	Dolomite								○	△
737	C541	23	PU	Limestone								○	△
738	I301	6	PU	Silicified Limestone	○								△
739	I304	6	PU	Silicified Limestone				○					△
740	I305	7	PU	Silicified Limestone								○	△
741	I309	7	PU	Silicified Limestone								○	△
742	I310	7	PU	Silicified Limestone				○					△
743	I311	6	PU	Dolomite								○	△
744	I312	7	CG	Granite porphyry	○								△
745	I320	11	PU	Silicified Limestone				○					△
746	I326	11	PU	Silicified Limestone	○								△
747	I327	11	PU	Limestone	○								△
748	I331	11	PU	Muddy Limestone								○	△
749	I333	11	PU	Dolomite								○	△
750	I335	11	PU	Dolomite								○	△
751	I353	9	PU	Limestone								○	△
752	I357	7	PU	Silicified Limestone				○					△
753	L301	21	PU	Limestone	○						○	○	△
754	L304	21	MP	Rhyolitic Tuff	○								△
755	L305	21	PU	Limestone	○	○							△
756	L306	21	PU	Dolomite								○	△
757	L311	21	PU	Limestone								○	△

Sample No.	Field No.	Location	Geological unit	Rock name	Thin section	Polished section	Chemical analysis (ore)	X-ray	Dating	Chemical analysis (whole rock)	Fossil	Minor element analysis	Geochemical analysis
758	L314	21	PU	Limestone				○				○	△
759	L315	21	PU	Possiliferous Limestone	○						○	○	△
760	L317	21	PU	Calcareous Dolomite				○					△
761	L318	21	PU	Dolomite				○				○	△
762	L319	21	PU	Limestone	○	○					○	○	△
763	L320	21	PU	Limestone		○						○	△
764	L321	21	PU	Limestone				○					△
765	L322	21	PU	Dolomite				○					△
766	L324	21	PU	Limestone	○	○							△
767	L328	21	PU	Limestone								○	△
768	L329	21	PU	Limestone	○	○							△
769	L331	21	PU	Limestone								○	△
770	L337	6	PU	Limestone	○						○	○	△
771	L338	6	PU	Limestone	○						○	○	△
772	L347	6	PU	Dolomite	○								△
773	L353	6	PU	Calcareous Dolomite	○							○	△
774	L358	6	PU	Limestone	○								△
775	L364	22	PU	Dolomite		○		○					△
776	L376	22	PU	Zebra Dolomite		○							△
777	L377	22	PU	Zebra Dolomite	○								△
778	L379	22	PU	Limestone	○							○	△
779	L382	22	PU	Calcareous Dolomite								○	△
780	L384	22	PU	Calcareous Dolomite								○	△
781	L386	22	PU	Limestone	○							○	△

Sample No.	Field No.	Location	Geological unit	Rock name	Thin section	Polished section	Chemical analysis (ore)	X-ray	Dating	Chemical analysis (whole rock)	Fossil	Minor element analysis	Geochemical analysis
782	L390	22	PU	Siliceous Dolomite	○			○					△
783	L392	22	PU	Dolomitic Limestone				○					△
784	L397	22	PU	Limestone								○	△
785	L410	11	PU	Zebra Dolomite								○	△
786	L416	11	PU	Banded Dolomite		○							△
787	L418	11	PU	Sandy Limestone				○					△
788	L426	11	PU	Brecciated Dolomite									△
789	L434	22	PU	Dolomite				○				○	△
790	L436	22	PU	Dolomite									△
791	L437	22	PU	Dolomite		○		○					△
792	L454	10	PU	Sandstone	○								△
793	L456	10	PU	Oolitic Sparite	○						○		△
794	L458	13	TR	Quartz porphyry									
795	L467	10	PU	Limestone								○	△
796	L481	10	CG	Gabbro	○								△
797	L492	10	PU	Brecciated Limestone								○	△
798	L497	10	TR	Welded Tuff	○								△
799	L503	22	PU	Dolomite	○	○							△
800	L522	9	PU	Brecciated Dolomite	○								△
801	L526	9	PU	Dolomite	○								△
802	L610	23	CH	Sandy Shale	○								
803	L614	22	PU	Brecciated Dolomite	○								△
804	L622	23	PU	Dolomite				○					△
805	L626	23	PU	Dolomite								○	△

Sample No.	Field No.	Location	Geological unit	Rock name	Thin section	Polished section	Chemical analysis (ore)	X-ray	Dating	Chemical analysis (whole rock)	Fossil	Minor element analysis	Geochemical analysis
806	L629	23	PU	Calcareous Dolomite								○	△
807	L635	23	PU	Dolomite								○	△
808	M307	8	PU	Dolomite								○	△
809	M312	8	PU	Dolomite								○	△
810	M314	8	PU	Aphanitic Limestone				○				○	△
811	M315	8	PU	Aphanitic Limestone								○	△
812	M329	8	PU	Aphanitic Limestone								○	△
813	M341	10	PU	Limestone								○	△
814	M343	10	PU	Limestone				○				○	△
815	M372	6	PU	Limestone				○				○	△
816	M380	22	PU	Calcareous Sandstone								○	△
817	M399	22	PU	Calcareous Sandstone								○	△
818	M401	22	PU	Zebra Dolomite								○	△
819	M403	22	PU	Aphanitic Dolomite								○	△
820	M411	22	PU	Dolomite								○	△
821	M413	22	PU	Brecciated Dolomite								○	△
822	M416	22	PU	Zebra Dolomite								○	△
823	M418	22	PU	Limestone								○	△
824	M427	11	PU	Dolomite								○	△
825	M435	11	PU	Dolomite								○	△
826	M436	11	PU	Limestone								○	△
827	M456	13	PU	Dolomite								○	△
828	M459	10	PU	Dolomite				○				○	△
829	M463	10	PU	Aphanitic Limestone								○	△

Sample No.	Field No.	Location	Geological unit	Rock name	Thin section	Polished section	Chemical analysis (ore)	X-ray	Dating	Chemical analysis (whole rock)	Fossil	Minor element analysis	Geochemical analysis
830	M465	22	PU	Limestone (dolomitic)								○	△
831	M466	22	PU	Zebra Dolomite								○	△
832	M469	22	PU	Dolomite								○	△
833	M492	9	PU	Aphanitic Limestone								○	△
834	M493	4	PU	Limestone	○								
835	M494	4	PU	Limestone		○	○						
836	M495	4	PU	Limestone		○							△
837	M496	4	PU	Dolomite								○	△
838	M505	9	PU	Limestone								○	△
839	M506	9	PU	Limestone								○	△
840	P319	8	PU	Dolomite								○	△
841	P321	8	CG	Granite	○								
842	P323	8	TR	Granite	○								△
843	P327	7	PU	Dolomite								○	△
844	P369	22	PU	Limestone								○	△
845	P385	22	PU	Zebra Dolomite								○	△
846	P411	22	PU	Dolomite								○	△
847	P421	22	PU	Limestone		○							△
848	P472	4	PU	Limestone								○	△
849	P490	4	PU	Limestone								○	△
850	P503	4	PU	Sandstone							○		
851	P511	13	PU	Dolomite								○	△
852	P521	10	TR	Welded Tuff	○								
853	P523	7	PU	Dolomite								○	△

Sample No.	Field No.	Location	Geological unit	Rock name	Thin section	Polished section	Chemical analysis (ore)	X-ray	Dating	Chemical analysis (whole rock)	Fossil	Minor element analysis	Geochemical analysis
854	P528	7	PU	Limestone								○	△
855	P555	8	TR	Quartz porphyry	○				○	○			
856	P556	8	PU	Limestone			○						
857	P562	8	PU	Dolomite	○								△
858	P563	8	PU	Chert	○								△
859	P565	8	TR	Quartz porphyry	○								
860	P579	8	PU	Limestone			○						
861	P584	8	PU	Limestone			○						
862	P586	8	PU	Limestone			○						
863	P588	8	PU	Limestone		○		○					△
864	P590	8	PU	Limestone			○						
865	S302	21	PU	Limestone		○							△
866	S306	21	PU	Limestone								○	△
867	S307	21	TR	Aplitic rock	○							○	△
868	S309	21	PU	Dolomitic Limestone								○	△
869	S310	21	PU	Dolomitic Limestone		○		○				○	△
870	S311	21	PU	Aphanitic Limestone				○				○	△
871	S312	21	PU	Limestone				○				○	△
872	S319	21	PU	Limestone								○	△
873	S320	21	PU	Fossiliferous Limestone								○	△
874	S321	21	PU	Limestone								○	△
875	S322B	21	PU	Limestone	○	○							
876	S323	21	PU	Limestone								○	△
877	S324	21	PU	Sparitic Limestone								○	△

Sample No.	Field No.	Location	Geological unit	Rock name	Thin section	Polished section	Chemical analysis (ore)	X-ray	Dating	Chemical analysis (whole rock)	Fossil	Minor element analysis	Geochemical analysis
878	S326	21	PU	Fosiliferous Limestone								○	△
879	S327	21	PU	Fosiliferous Limestone	○		○				○		
880	S341	6	PU	Silicified Limestone								○	△
881	S343	22	PU	Lead-Zinc	○	○							
882	S345	22	PU	Dolomite			○					○	
883	S346	22	PU	Lead-Zinc	○	○	○	○					
884	S347	22	PU	Dolomite			○					○	
885	S348	22	PU	Dolomite			○						
886	S349	22	PU	Dolomite			○	○				○	
887	S350	22	PU	Lead-Zinc			○					○	
888	S351	22	PU	Lead-Zinc	○	○	○	○					
889	S352	22	PU	Dolomite			○	○				○	
890	S376	6	PU	Sandstone								○	△
891	S377	6	PU	Limestone								○	△
892	A339	HC	TV	Granite	○								
893	A381	SC	PU	Siliceous Limestone	○								
894	A386	SC	PU	Limestone	○								
895	C372	RY	SA	Arkose Sandstone	○								
896	C374	RY	CH	Limestone	○								
897	C379	RY	TV	Granodiorite	○								
898	X344	TG	PU	Andesitic Tuff	○								
899	P445	HC	PU	Sandstone							○		
900	P457	HC	TV	Granite	○								
901	P458	HC	TV	Andesite	○								

Sample No.	Field No.	Location	Geological unit	Rock name	Thin section	Polished section	Chemical analysis (ore)	X-ray	Dating	Chemical analysis (whole rock)	Fossil	Minor element analysis	Geochemical analysis
902	A345	C13	PU	Dolomitic Limestone	○						○		
903	A346	C13	PC	Diorite	○					○			
904	A352	C14	PU	Limestone	○						○		
905	A357	C14	PU	Limestone			○						
906	A359	C14	PU	Limestone	○						○		
907	A363	C13	PU	Limestone	○						○		
908	A376	B17	PU	Limestone	○						○		
909	A388	C14	MI	Rhyolite	○								
910	C367	B17	SA	Andesitic Tuff	○								
911	I347	B17	PU	Black Limestone							○		
912	L441	D13	MI	Porphyrytic Rhyolite	○								
913	L442	D13	MI	Dacitic Tuff Breccia	○								
914	L443	D13	PU	Limestone	○								
915	L446	D12	PU	Limestone	○								
916	L512	P4	MD	Monsonite	○				○	○			
917	L514	P4	MD	Granodiorite	○					○			
918	L516	P4	MD	Diorite	○	○							
919	L517	P4	MI	Shale	○								
920	M451	E12	PU	Black Limestone							○		
921	P541	E4	MI	Quartz porphyry	○								
922	P543	E4	MI	Dolerite	○	○							
923	P546	E4	MI	Porphyrite	○								
924	P547	E4	MI	Andesitic Tuff	○								

A. I - 2. Microscopic observation of the thin sections

Sample No.	Field No.	Locality	Formation	Rock Name	Microscopic Observation
686	A301	8	PU	Micrite	Silt sized detrital quartz (less than 10 per cent) and about 15 per cent of fossil fragments, which are replaced perfectly by coarsely crystalline calcite, are cemented by finely recrystallized anhedral mosaic of calcite.
692	A318	10	CG	Granite	Rock shows granular texture and composed mainly of quartz (subhedral or anhedral, weakly sheared but can not be observed wave extinction), alkali feldspar (subhedral or anhedral, mostly perthite), plagioclase (anhedral or subhedral, oligoclase, zonning clear, altered to fine mixture of sericite and clay mineral), biotite (anhedral, bending cleavage, weak pleochroism, many part altered to chlorite) and a small quantity of iron ore.
700	A333	20	TR	Quartz porphyry	Rock shows porphyritic texture and composed mainly of quartz (anhedral rounded, 3.60 x 1.62 – 0.25 x 0.03 mm, many cracks), alkali feldspar (anhedral rounded, orthoclase and perthite, 1.85 x 1.00 – 0.88 x 0.72 mm, pale gray color, inclusion of square black magnetite, and embayed sericite), plagioclase (euhedral, 0.64 x 0.45 – 0.25 x 0.10 mm, An=25–20, dirty crystal, weak twinning plane, marginal altered to sericite) and biotite (1.41 x 0.34 – 0.76 x 0.12 mm, altered to fine mixture of iron ore and sericite). Black square magnetite occurs as accessory mineral. Groundmass is net texture and consists of aggregation of fine sericite and undetermined clay minerals. Only one fan figure muscovite occurs with biotite.
701	A335	20	PU	Andesitic tuff	Rock shows granular texture with weak schistosity. Constituent minerals are quartz (irregular anhedral, less than 0.08 x 0.06 mm), and calcite (irregular grain, less than 0.18 x 0.10 mm). Matrix is filled by pale brown clay undetermined mineral and pale gray volcanic ash. Fragments of andesitic rock (less than 0.95 x 0.80 mm, probably pyroxen andesite) occurs.
705	A414	23	PU	Oosparite	Original rock is oosparite, which consists of more than 70 percent of oolite and rather coarse sparry calcite matrix. Original textures are still remained, but particles have been replaced perfectly by fine anhedral mosaic of dolomite.

Sample No.	Field No.	Locality	Formation	Rock Name	Microscopic Observation
728	C411	4	MP	Quartz porphyry	Consists mainly of very fine grains of quartz (irregular anhedral over 90 per cent) and feldspar (a few per cent). Rock is intruded by quartz and aplitic veins.
738	I301	6	PU	Biomicrite	More than 80 per cent of fragmental sponge secules are cemented by microcrystalline calcite. Small pellet like aggregations of clayey matter are observed sporadically. Rock is weakly recrystallized.
744	I312	7	CG	Granite Porphyry	Rock shows porphyritic texture and composed of quartz (1.44 x 0.92 – 0.12 x 0.09 mm, anhedral), alkali feldspar (subhedral, almost perthite, 3.26 x 2.06 – 0.40 x 0.15 mm), plagioclase (euhedral - subhedral, 1.96 x 0.30 – 0.25 x 0.06 mm) and anhedral magnetite. Groundmass shows fine fluidal texture and consists of mixture of plagioclase and pale gray glass.
746	I326	11	PU	Micrite	Composed mainly of very fine microcrystalline calcite with irregular shaped cavities, which are filled by sparry calcite.
747	I327	11	PU	Biosparite	More than 70 per cent of fragments of calcareous algae, echinoid spine and molluscan shell are cemented by coarsely crystalline sparry calcite. Rock is more or less recrystallized.
754	L304	21	PU	Rhyolitic tuff	Many angular fragments of quartz are scattered in volcanic ash. Plagioclase (euhedral, less than 0.90 x 0.56 mm, weakly altered to sericite), biotite (euhedral or anhedral, less than 0.36 x 0.03 mm, weak pleochroism), anhedral magnetite and alkali feldspar (anhedral, perfectly altered to fine clay mineral) occur as accessory minerals.
755	L305	21	PU	Micrite	Rock is composed mainly of very fine microcrystalline calcite with a few per cent of subangular very fine grained quartz. Rock is crushed tectonically and cemented by coarsely crystalline calcite.
766	L324	21	PU	Micrite	Less than 30 per cent of shell fragments of bivalves, gastropods and ostracods, about 10 per cent of very fine to silt sized subangular quartz, and spherical aggregates of clayey matter are cemented by very fine microcrystalline calcite. Shell materials are replaced perfectly by coarsely crystalline calcite.

Sample No.	Field No.	Locality	Formation	Rock Name	Microscopic Observation
768	L329	21	PU	Micrite	More than 50 per cent of shell fragments of echinoids and 10 to 20 per cent of very fine grained angular detrital quartz are cemented by microcrystalline calcite. Fossil remains are perfectly replaced by coarse calcite crystals.
772	L347	6	PU	Dolomite	Composed mainly of finely crystalline (less than 0.1 mm) anhedral mosaic of dolomite, and 15 per cent or more of very finely crystalline quartz which is originatted from hydrothermal solution.
773	L353	6	PU	Dolomite	Composed mostly of medium crystalline (less than 0.2 mm) anhedral mosaic of dolomite with a few per cent of very fine grained detrital quartz.
774	L358	6	PU	Pelmicrite	Less than 10 per cent of shell fragments, about 20 per cent of fine grained detrital quartz and pellets are cemented by muddy microcrystalline calcite. Micritic matrix, shell fragments and pellets are incompletely recrystallized to fine to coarse anhedral mosaic of calcite. Sporadical aggregations of fine crystalline quartz, originated from hydrothermal solution, are observed.
777	L377	22	PU	Dolomite	Composed mainly of anhedral mosaic of medium crystalline dolomite.
778	L379	22	PU	Biomicrite	Rather coarsely recrystallized fossil remains are cemented by microcrystalline calcite, and discrete rhombs of dolomite replacing coarse calcite selectively.
781	L386	22	PU	Biomicrite	Spherical radiolarian shell and spine, which are replaced perfectly by calcite, are cemented by microcrystalline calcite.
782	L390	22	PU	Dolomite	Very fine (less than 0.1 mm) anhedral mosaic of dolomite.
792	L454	10	PU	Sandstone	Medium grained subangular quartz (nearly 75 per cent) and detrital grains of chert (about 20 per cent) are cemented by silica and clary matter.

Sample No.	Field No.	Locality	Formation	Rock Name	Microscopic Observation
796	L481	10	CG	Gabbro	Rock shows granular and ophitic texture, and is composed of plagioclase (euhedral – subhedral, less than 2.74 x 0.60 mm, An=82 – 70), brown hornblende (less than 0.68 x 0.42 mm), green hornblende (less than 0.25 x 0.08 mm), augite (subhedral, 0.30 x 0.16 – 0.50 x 1.37 mm, CAZ 42°), olivine (anhedral, less than 0.40 x 0.18 mm, altered to serpentine along cracks) and magnetite (subhedral or anhedral, 0.42 x 0.14 – 0.08 x 0.07 mm).
798	L497	10	TR	Welded tuff	Rock shows porphyritic texture and is composed of anhedral-subhedral quartz, subhedral altered plagioclase, euhedral altered hornbrende and a small quantity of magnetite. Fragments of biotite quartz schist and shale occur in matrix. Matrix consists of volcanic ash, long lenticular pumice and glass showing strong welded structure.
799	L503	22	PU	Dolomite	Composed of rather uniform anhedral mosaic of medium crystalline (less than 0.2 mm) dolomite.
800	L522	9	PU	Dolomite	Rock is originally muddy pelmicrite, and has been partially silicified to calcareous chert. Original texture of pelmicrite is still recognized in dolomite. Still later, calcareous particles have been replaced by rhombs or anhedral mosaic of dolomite nearly perfectly in pelmicrite as well as in chert.
801	L526	9	PU	Dolomite	Original texture of biomicrite is still remained obscurely, although particles have been completely replaced by fine anhedral mosaic of dolomite.
802	L610	23	CH	Sandy shale	Fine to very fine angular grains of detrital quartz and calcite grains are cemented by red colored calcareous silty matrix.
803	L614	22	PU	Brecciatted Dolomite	Medium crystalline dolomite breccias are cemented by coarsely crystalline calcite veins.
834	M493	4	PU	Biomicrite	Small fragmental shells of foraminifera and ostracods, and less than 10 per cent of very fine grained detrital quartz are cemented by microcrystalline calcite.

Sample No.	Field No.	Locality	Formation	Rock Name	Microscopic Observation
841	P321	8	CG	Granite	Rock shows coarse granular texture and is composed of quartz (anhedral, many bubbles), alkali feldspar(fresh perthite, altered orthoclase) and muscovite (anhedral, less than 4.97 x 2.06 mm). Sphene occurs as accessory mineral.
842	P323	8	TR	Granite	Rock shows granular texture and composed of quartz (anhedral, 1.54 x 0.67 - 0.16 x 0.12 mm), alkali feldspar (subhedral or anhedral, 1.70 x 1.02 - 0.25 x 0.12 mm, mainly microcline) and biotite (anhedral, 0.30 x 0.26 - 0.08 x 0.03 mm, X=pale yellow, Z=greenish brown, partially altered to chlorite). Anhedral sphene occurs as accessory mineral.
852	P521	10	TR	Welded tuff	Quartz (subhedral, less than 0.17 x 0.08 mm), plagioclase (euhedral or subhedral, 1.34 x 0.88 - 0.13 x 0.05 mm, altered to clay perfectly), hornblende (euhedral or subhedral, less than 0.18 x 0.10 mm, black ghost crystal, sericite occurs in marginal part) and biotite (subhedral, only one, 0.84 x 0.17 mm, inner part is sericite, marginal part is black). Matrix shows strong welded and consists of many recrystallized tiny quartz and volcanic pale gray ash.
855	P555	8	TR	Quartz porphry	Rock shows porphyritic texture and is composed mainly of quartz (subhedral, 1.54 x 1.04 - 0.20 x 0.16 mm) and hornblende (euhedral, less than 0.14 x 0.08 mm, marginal part black and inner part sericite due to alteration). Zoisite from plagioclase and calcite occur as secondary mineral. Groundmass is fine net texture and wholly glass, consists of fine aggregation of tiny quartz grain,and pale gray clay by weak carbonitization and silicification.
857	P562	8	PU	Dolomite	Composed of finely crystalline anhedral mosaic of dolomite.
858	P563	8	PU	Chert	Rock is originally limestone with sponge spicules, and is partially silicified to calcareous chert. Still later, calcareous particles are replaced complately by rhombs of dolomite.

Sample No.	Field No.	Locality	Formation	Rock Name	Microscopic Observation
859	P565	8	TR	Quartz porphyry	Rock shows porphyritic texture and composed mainly of quartz (subhedral or anhedral), alkali feldspar (euhedral or subhedral, altered to sericite perfectly), biotite (subhedral, perfectly decomposed), and plagioclase (subhedral, perfectly decomposed). Groundmass is wholly glass, and includes many tiny quartz and sericite with silicification or sericitization.
867	S307	21	TR	Aplitic Rock	Rock is strongly kaolinitized and silicified. Alkali feldspar (subhedral, 2.40 x 1.85 - 0.38 x 0.30 mm), plagioclase (euhedral, 2.01 x 0.80 - 0.42 x 0.21 mm) and quartz (anhedral, less than 1.40 x 0.80 mm) occurs as relic minerals. Only one small zircon is recognized. Recrystallized fine quartz occurs in whole section.
875	S322-B	21	PU	Limestone	Original texture of biomicrite is remained obscurely, but particles are recrystallized to rather coarsely crystalline calcite.
881	S343	22	PU	Ore bearing Dolomite	Coarse grained subhedral or anhedral mosaic of dolomite with a few smithsonite derived from sphalerite. Sphalerite is light brown in color but very rare. The refractive index of smithsonite is higher than that of dolomite.
883	S346	22	PU	Ore bearing Dolomite	Medium to coarse grained subhedral mosaic of dolomite with a few smithsonite derived from sphalerite. Sphalerite is light brown in color and exists along fracture or fissure. Almost sphalerite is replaced by smithsonite.
888	S351	22	PU	Ore bearing Dolomite	Medium to coarse grained subhedral mosaic of dolomite. Sphalerite is rarely observed along fissure or fracture but is almostly replaced by zinc carbonate, smithsonite.
892	A339	Hc	TV	Granite	Rock shows granular texture and composed mainly of quartz (subhedral - anhedral, 1.70 x 1.55 - 0.13 x 0.11 mm), plagioclase (subhedral, 1.42 x 1.10 - 0.51 x 0.25 mm, altered to fine mixture of clay mineral and sericite), and alkali feldspar (euhedral or subhedral, up to 0.68 x 0.51 mm, altered to clay and sericite perfectly). Mafic minerals are a small quantity of muscovite (anhedral, 0.77 x 0.16 - 0.20 x 0.06 mm) and biotite (anhedral, less than 0.16 x 0.03 mm), decomposed to sericite mixture. Hematite occurs as secondary mineral.

Sample No.	Field No.	Locality	Formation	Rock Name	Microscopic Observation
893	A381	Sc	PU	Pelmicrite	Original rock is nearly 30 per cent of very fine grained detrital quartz and more than 50 per cent of pellets cemented by microcrystalline calcite. Micritic matrix and pellets are changed to finely crystalline anhedral mosaic of calcite by recrystallization, with scattered rhombs of dolomite.
894	A386	Sc	PU	Limestone	Original rock is sandy pelmicrite as nearly same as A 381. Original texture is still recognized although particles are replaced perfectly by fine anhedral mosaic of dolomite.
895	C372	Ry	SA	Arkose Sandstone	Very coarse to medium grained subangular quartz(about 55 per cent) and alkali feldspar (nearly 40 per cent, mainly perthite) are cemented by a small quantity of carbonate and clayey matrix.
896	C374	Ry	CH	Limestone	Rock consists wholly of very coarsely recrystallized anhedral mosaic of calcite, although an original texture of thin lamination is still recognized.
897	C379	Ry	TV	Granodiorite	Rock shows granular texture and composed mainly of quartz (anhedral, less than 0.35 x 0.24 mm), alkali feldspar (euhedral subhedral, dirty, 1.64 x 0.72 – 0.44 x 0.30 mm), plagioclase (euhedral or subhedral, less than 1.82 x 0.78 mm) and hornblende (anhedral or subhedral, less than 0.65 x 0.42 mm). Biotite (anhedral, less than 0.49 x 0.011 mm, perfectly altered to green chlorite), apatite (euhedral, less than 0.14 x 0.02 mm) and sphene occur as accessory mineral.
898	I344	TG	PU	Andesitic tuff	Plagioclase (euhedral or subhedral, less than 0.42 x 0.16 mm, altered to mixture of quartz and hydrous iron oxides), quartz (subhedral – euhedral, less than 0.10 mm), zircon (only one, euhedral, 0.04 x 0.01 mm) and phlogopite (subhedral, X=colorless, Z=pale yellow) occur in brown volcanic ash matrix.

Sample No.	Field No.	Locality	Formation	Rock Name	Microscopic Observation
900	P457	Hc	TV	Granite	Rock shows granular texture and composed mainly of quartz (anhedral, 0.25 x 0.16 mm), alkali feldspar (subhedral, mainly perthite, 0.18 x 0.16 mm), plagioclase (subhedral, perfectly altered, less than 0.77 x 0.21 mm) and biotite (subhedral - anhedral, 0.60 x 0.82 - 0.08 x 0.06 mm, bending cleavage). Sphene (anhedral, 0.33 x 0.18 mm) and magnetite (subhedral or anhedral occur as accessory mineral.
901	P458	Hc	TV	Andesite	Rock shows porphyritic texture and perfectly altered. Plagioclase (euhedral or subhedral, 0.34 x 0.13 - 0.16 x 0.06 mm, altered to clay) and hornblende (euhedral or subhedral, black unclear crystal) are phenocrysts. Groundmass consists of mixture of clay minerals, iron hydroxide, and tiny grains of quartz.
903	A346	C13	PC	Diorite	Rock shows granular texture and composed mainly of quartz (subhedral or anhedral, 0.95 x 0.60 - 0.05 x 0.01 mm, cataclastic and mosaic figure by stress), plagioclase (subhedral or nahedral, 1.64 x 0.80 - 0.20 x 0.05 mm, all large crystals altered to fine mixture of sericite and zoicite, small ones are fresh and An=64-58), hornblede (subhedral, 1.00 x 0.42 mm, Z=green, X=greenish brown) and biotite (anhedral, 1.20 x 0.14 mm, X=yellow, Z=pale brown).
909	A388	C14	Mi	Rhyolite	Rock shows glassy and composed mainly of plagioclase (euhedral or subhedral, less than 0.80 x 0.45 mm, perfectly decomposed) and hornblende (subhedral, less than 0.40 x 0.12 mm, gray unclear crystal by perfect alteration). Groundmass encloses many isolated spherulites (less than 0.50 x 0.45 mm).
910	C367	B17	SA	Andesitic tuff	Composed of quartz (subhedral or anhedral, less than 0.25 x 0.18 mm, cataclastic structure or wavey extinction), iron mineral (rounded, less than 0.15 x 0.12 mm) and many calcite cements as secondary mineral. Rarely ash globes (less than 0.18 x 0.19 mm) are recognized. Andesite fragments are observed in pale brown ash matrix.

Sample No.	Field No.	Locality	Formation	Rock Name	Microscopic Observation
912	L441	D13	Mi	Porphyritic rhyolite	Groundmass is composed of very coarse to fine grained quartz (more than 50 per cent, irregular anhedral) and feldspar (about 30 per cent, mostly perthite), which is partly altered to chlorite and sericite. Phenocrysts of quartz are rarely observed.
913	L442	D13	Mi	Dacitic tuff breccia	Rock consists of quartz (subhedral, less than 0.30 x 0.18 mm) alkali feldspar (subhedral, less than 0.48 x 0.20 mm), and plagioclase (eubderal or subhedral, less than 0.45 x 0.22 mm). Matrix is composed of brown or black ash with many subrounded or rounded fragments of pyroxene andesite, acidic andesite, schist, shale and pumice.
914	L443	D13	PU	Pelmicrite	Pellets, several per cent of fine grained detrital quartz and some fossil fragments (radiolarian and echinoids) are cemented by microcrystalline calcite.
915	L446	D12	PU	Limestone	Coarse to fine anhedral mosaic of calcite, which is originated from crinoidal biomicrite with chert grains.
916	L512	F4	MD	Monzonite	Rock shows granular texture and composed of quartz (anhedral, 0.98 x 0.80 - 0.22 x 0.15 mm), alkali feldspar (subhedral, less than 1.25 x 0.85 mm), plagioclase (subhedral, 0.80 x 0.60 mm ±) and biotite (subhedral, 1.14 x 0.88 mm ±, very weak pleochroism).
917	L514	F4	MD	Granodiorite	Granular texture and composed of quartz (anhedral, 0.21 x 0.21 mm ±), feldspar (all decomposed perfectly), hornblende (subhedral, 1.45 x 0.60 mm ±, X=green, Z=yellow) and biotite (anhedral or subhedral, 1.96 x 0.65 - 0.10 x 0.04 mm, X=pale green, Z=pale brown). Some of mafic minerals occur as embayed crystals.
918	L516	F4	MD	Diorite	Rock shows coarse granular texture, and is composed of quartz (subhedral or anhedral, wavey extinction), feldspar (euhedral - subhedral, perfectly altered to clay mineral), hornblende (perfectly altered to chlorite, anhedral) and a small quantity of magnetite.
919	L517	F4	Mi	Shale	Very fine grained detrital quartz, feldspar, chert and fragments of andesite are cemented by silt and tuffaceous matrix. Tuffaceous matrix is altered distinctly.

Sample No.	Field No.	Locality	Formation	Rock Name	Microscopic Observation
921	P541	E4	Mi	Quartz porphyry	Rock shows porphyritic texture and is composed mainly of quartz (subhedral or anhedral, 2.88 x 1.65 – 0.18 x 0.14 mm), feldspar (euhedral or subhedral, 0.92 x 0.80 – 0.40 x 0.22 mm, fine aggregations of sericite and clay minerals) and hornblende (euhedral, less than 0.21 x 0.14 mm, misty crystals). Groundmass is glassy and altered to fine mixture of clay minerals and sericite.
922	P543	E4	Mi	Dolerite	Rock shows porphyritic texture and is composed mainly of olivine (subhedral or anhedral, 1.58 x 0.70 – 0.35 x 0.21 mm, altered to antigolite perfectly) and augite (subhedral, 1.30 x 1.15 mm, altered to fine mixture of iron ore and plagioclase perfectly) as phenocrysts. Groundmass shows intersertal texture and consists of augite (euhedral, 0.28 x 0.02 mm, C Z=40° – 43°), ilmenite (euhedral prismatic, less than 0.20 x 0.02 mm) and plagioclase (euhedral, less than 0.80 x 0.15 mm, long prismatic, altered to clay minerals).
923	P546	E4	Mi	Porphyrite	Rock shows porphyritic texture, and is composed of plagioclase (euhedral or subhedral, 0.50 x 0.14 – 0.24 x 0.07mm, are altered to recrystallized quartz perfectly) and decomposed mafic mineral (0.25 x 0.20 – 0.08 x 0.06 mm, fine aggregation of iron ore and quartz). Groundmass is very fine mixture of sericite and quartz, and shows fluidal texture partly.
924	P547	F5	PU	Andesitic tuff	Rock shows porphyritic texture and is composed of hornblende (euhedral or subhedral, 0.26 x 0.20mm, unclear crystal, fine aggregation of iron ore and plagioclase) and quartz (subhedral or anhedral, 0.60 x 0.35 – 0.18 x 0.03 mm, wavey extinction). Structure of matrix is not sure, but may be altered the matrix by decomposition and strong silicification or chloritization. It consists of recrystallized fine quartz and chlorite.

A. I - 3. Microscopic observation of the polished sections

Sample No.	Field No.	Locality	Rock Name	Reflecting Microscopic Observation
689	A308	8	Dolomite	The specimen is dolomite with palo brown color. Under the ore microscope, besides a few pyrite and iron oxide and/or hydroxide, probably hematite and geothite, opaque mineral is not observed. Hematite occurs as separate grains of 10 to 30 microns in general size or sometimes as grains rimmed by goethite. Pyrite occurs as small individual grain or thin veinlet along the cracks.
690	A309	8	Dolomite	The specimen is pale brown dolomite, appearing quite similar to the specimen A-308. Under the ore microscope, many iron oxide and/or hydroxide grains, 50 to 100 microns in general size, and also irregular shaped veinlet 80 to 150 microns in width,which consist of hematite and goethite, are observed. No galena and no sphalerite is found.
712	C308	4	Dolomite	The specimen is very fine grained dolomitic limestone with dark brown color. Fair number of iron oxide and iron hydroxide grains are observed but sphalerite and galena are not found. Iron hydroxide and oxide grains, possibly being composed of hematite and goethite, occur as small spherular grains of hematite core with goethite rim or as irregular shaped aggregate masses less than 60 microns in size. Very fine grain of pyrite, several microns in size, are also observed.
731	C416	21	Galena bearing dolomite	The specimen is galena ore. Several grains of galena up to 7 mm in size are observed megascopically on the polished dolomite surface. Under the microscope, it is observed that galena is replaced by lead carbonate, cerussite, in irregular or network forms. Cerussite is gray in color with strong anisotropism under the crossed nicols and is very similar to gangue dolomite, but it is determined by means of X-ray powder method using a Debye-Scherrer camera. Very a few fine grain of sphalerite, 5 to 20 microns in size, also observed. Some iron hydroxide grains, perhaps goethite with some hematite and relict pyrite, of 30 to 150 microns in size are found. Fine pyrite cube crystals, 5 to 20 microns, are also found. Cu Pb Zn 0.02%, 2.48%, 0.42%

Sample No.	Field No.	Locality	Rock Name	Reflecting Microscopic Observation
755	L305	21	Galena bearing dolomite	The specimen is pale is brown colored dolomite containing some galena crystal grains in megascopically size up to 3 mm. Galena is replaced or rimmed by irregular shaped cerussite as same as Sample C-416. Besides galena, many iron hydroxide grains of 10 to 60 microns in size, may be mainly goethite, are observed. Iron hydroxide veinlet composed of small goethite spherulite, 10 to 20 microns in size, is found along fine crack of dolomite. Fine pyrite grains, 5 to 20 microns, are also found. Cu Pb Zn 11ppm, 7300ppm, 350ppm
762	L319	21	Dark colored	The specimen is limestone of dark brown or black color on polished surface. Under the microscope, galena and sphalerite are not found. Only iron hydroxide grains, masses or network, mainly goethite, and small pyrite are observed. Pyrite sometimes occurs as aggregates of colloform spherulites of 5 to 20 microns. Among goethite frequently fine pyrite relict grains are recognized. Cu Pb Zn 15ppm, 5120ppm, 152ppm
763	L320	21	Limestone (Containing Galena)	The specimen is pale brown colored limestone. A few small grains of galena, 40 microns in max. and 10 to 20 microns in general size, are recognized. Besides galena only goethite with fine pyrite relict inside less than 50 microns and tiny pyrite, 2 to 10 microns, are observed. Some iron hydroxides occur as fine disseminated colloform spherulites. Cu Pb Zn 13ppm, 813ppm, 216ppm
766	L324	21	Dark colored Limestone	The specimen is dark colored limestone. Under the microscope, very few opaque mineral is observed. Several sphalerite grains, 45 microns in maximum and 20 microns in general size, and only one fine galena of 15 × 35 microns are found. Goethite, 5 to 25 microns, and tiny pyrite, 3 to 10 microns, also seen separately. Cu Pb Zn 4ppm, 414ppm, 690ppm

Sample No.	Field No.	Locality	Rock Name	Reflecting Microscopic Observation
768	L329	21	Dark colored Limestone	The specimen is limestone with dark brown or black color on polished surface. Opaque mineral is just a few. A small number of galena less than 40 microns, hematite-like mineral grain, and goethite grains with pyrite relicts less than 120 microns are observed. Cu Pb Zn 12ppm, 424ppm, 556ppm
775	L364	22	Banded dolomite	The specimen is dolomite with pale brownish gray in color. Under the microscope, it is observed that the specimen is composed of rather coarse grains of dolomite and they show sometimes distinct idiomorphic crystal forms. Besides pyrite grains, less than 10 microns, no opaque mineral is observed. Cu Pb Zn 11ppm, 45ppm, 23ppm
776	L376	22	Zebra dolomite	The specimen is dolomite with so-called zebra structure megascopically. As same as Sample L-364 the dark gray part consists of smaller dolomite grains of 100 to 200 microns but the light part is composed of rather large dolomite grains of 400 to 500 microns. Besides a few fine separate grains of sphalerite, some relatively large iron hydroxide masses and several microns of pyrite crystals are observed. Iron hydroxide masses, 400 to 500 microns in size, consist of hematite-like minerals core and encrustered goethite. Cu Pb Zn 3ppm, 38ppm, 18ppm
786	L416	11	Banded dolomite	The specimen is banded dolomite composed of dark brown and pale brown (white) parts. Both of the dark and the white parts consist of dolomite but different in size. In the dark part it is 50 to 150 microns in size but in the white part as large as 500 to 800 microns, sometimes over 1 mm in grain size. Sphalerite grain, 600 × 900 microns in size, and several its veinlets having irregular shape, 20 to 90 microns in width, are observed. Among the white part. A rim of the shphalerite is partly replaced by zinc carbonzte, smithsonite. In the dark brown part considerable many iron oxide or hydroxide grains are observed. They occur in general in form of rectangular and their size is usually several ten microns but sometimes reaches as large as 450 microns. They consist of hematite core and goethite rim or fine mixture of them. Very a few fine galena crystals are found also in the dark part of the specimen. Cu Pb Zn 5ppm, 28ppm, 10ppm

Sample No.	Field No.	Locality	Rock Name	Reflecting Microscopic Observation
791	L437	22	Dark colored dolomite	The specimen is dark brown colored dolomite without any metallic mineral megascopically. Under the microscope, few opaque minerals are observed. Only goethite grains, 60 microns in maximum and 5 to 30 microns in general size and commonly in cubic form, are seen among gangue dolomite. Bright yellow grains of 2 to 5 microns, very similar to gold, are found, but it could not confirmed because of their small size. Cu Pb Zn 2ppm, 34pp, 14ppm
799	L503	22	Dark colored dolomite	The specimen is dark colored dolomite. It is mainly composed of nearly equigranular dolomite crystals of 100 to 250 microns. Besides, iron hydroxide grains, less than 60 microns, fine separate grains of sphalerite 10 to 20 microns, and pyrite of several microns are only observed. Cu Pb Zn 22ppm, 39ppm, 20ppm
835	M494	4	Limestone	The specimen is compact limestone with black color. Under the microscope, it is observed that the veinlet, several hundred microns in width and being composed of coarse grain of calcite, is cutting across the fine grain matrix. Among the fine grain matrix, fine iron hydroxide, possibly goethite, and pyrite less than 10 microns are observed. Sometimes hematite grain rimmed by goethite reaches as large as 40 microns. Only a few grains of sphalerite, less than 20 microns in size, are found beside or in the veinlet of coarse grain of calcite.
836	M495	4	Limestone	The specimen is compact limestone with black in color and is very similar appearance megascopically. It consists of very fine grain of calcite. Fairly many separate grains of sphalerite, 100 microns in maximum and 40 to 60 microns in general size, are observed. Most of sphalerite grains are replaced more or less by smithsonite. Very irregular shaped magnetite like minerals, brownish gray color and isotropic, are also found. Sphalerite and magnetite like mineral occur in rather coarse grain of calcite, over 100 microns, than general matrix fine limestone. Iron hydroxide less than 30 microns, usually 10 microns in size, and very fine pyrite grains are also found.

Sample No.	Field No.	Locality	Rock Name	Reflecting Microscopic Observation
847	P421	22	Limestone	The specimen is very compact limestone with black color. Under the ore microscope, it is observed that the specimen consists of very fine grains of calcite, 5 to 20 microns in general size. Opaque mineral is very few. Only pyrite, several ten microns or less in size and iron oxide grains are found in fine matrix.
863	P588	8	Limestone	The specimen is rough and porous limestone with brown color. Under the microscope, many cavities or pores are observed and calcite occurs in form of idiomorphic wedge like crystals of 40 to 80 microns in size. Very few galena fine grains are found in cavities of limestone and very fine grains of pyrite, some are spherical in shape, are also observed in cavities. Sphalerite is not found both in microscopic and X-ray powder diffraction.
865	S302	21	Zebra dolomite	The specimen is banded dolomite of deep to light brown in color. Under the microscope, galena and sphalerite are not found among gangue dolomite. In the part of thin veinlet, less than 0.3 mm in width, many hematite with metallic luster occur in form of rectangular or sometimes triangular. They are 250 microns in maximum and 100 to 150 microns in size and generally replaced and rimmed by goethite and also associated with irregular masses or network of iron hydroxides. Though zinc mineral is not recognized, zinc is detected from the part of iron hydroxide masses by EPMA. Cu Pb Zn 10ppm, 230ppm, 910ppm
869	S310	21	Dolomitic limestone	The specimen is dolomitic limestone with light brown in color. Opaque minerals are not so many observed. A few fine grains of galena and pyrite, less than 20 microns are observed. And iron oxide and/or hydroxide grains, less than 50 microns, are also found, however, sphalerite is not observed. By the EPMA examinations, the tiny portions at where zinc is concentrated in considerable amount, are detected, but it is hardly to identify it from calcite matrix under the microscope. It seems to be most possible that zinc exist as fine grains of carbonate, probably smithsonite, however, the existence of smithsonite is not confirmed even by X-ray powder diffraction.

Sample No.	Field No.	Locality	Rock Name	Reflecting Microscopic Observation
875	S322-B	21	Dark colored Limestone	The specimen is limestone with dark brown to black color in polished section. Under the microscope, only a few small separate grains of sphalerite, 10 to 25 microns, and a galena grain, 10 x 40 microns, are found among gangue minerals. Hematite occurs partly in form of thin string of snake-like.
888	S351	22	Zinc Ore	The specimen is sphalerite bearing dolomite. One edge of the polished specimen a brown colored elongated mass, looks iron oxides, is observed megascopically. This portion mainly consists of iron hydroxide and sphalerite. Sphalerite, white with pale brownish tint in reflection color, is replaced by zinc carbonate, smithsonite. Smithsonite shows low reflection behavior as similar to gangue dolomite and then it is very hard to distinguish each other. Replacement of sphalerite by smithsonite progresses considerably and they show "shredded", "island shaped", or "lattice shaped" textures. The grains supposed to be replaced completely by smithsonite are sometimes observed. Iron hydroxide occurs as separate grains, less than 400 microns, of goethite associated with hematite-like mineral and relict pyrite, or as complicated network. Besides them, fine pyrite of 5 to 20 microns in size are found among dolomite. Cu Pb Zn 0.01%, 0.02%, 8.80%
881	S343	22	Zinc Ore	The specimen is sphalerite-bearing pale colored dolomite. Sphalerite is observed megascopically as pale brownish or pale grayish color with semi-metallic luster on the polished section. Under the microscope, sphalerite shows white with faint brownish tint in reflection color and it gives numerous white, yellow, or brownish internal reflection which disturbs isotropic darkness under the crossed nicols. Sphalerite is replaced by smithsonite and they show the textures of "veinlet network", "scratched", "shredded", "island shaped", or "lattice shaped". Smithsonite is gray in reflection color with pleochroism which is very similar to gangue dolomite, however, smithsonite gives characteristic fancy milky yellowish internal reflection under the crossed nicols. As only by the microscopic observation it is difficult to identify smithsonite from dolomite, it was confirmed by the X-ray powder diffraction. Hematite grains, 50 to 100 microns in size, some goethite grains less than 40 microns, and fine pyrite of several microns are found as independent grains among gangue.

Sample No.	Field No.	Locality	Rock Name	Reflecting Microscopic Observation
883	S346	22	Zinc Ore	The specimen is sphalerite-bearing dolomite composed of dark colored and white colored portions. The white part consists of rather larger crystals of dolomite than those in the darker part. Several sphalerite masses up to 5 mm are observed megascopically among dolomite. Under the microscope, sphalerite is replaced by smithsonite just as same as before mentioned samples S-351 and S-343, but the grade of replacement is relatively low in this specimen. A fairly numbers of iron hydroxide grains, probably goethite with fine pyrite relict inside and less than 120 microns in size, are observed, and some of them show cubic form of pseudomorph after pyrite. Fine pyrite less than 20 microns are also found. Cu Pb Zn 0.02%, 0.02%, 22.85%
918	L516	P4	Diorite	The specimen is diorite of pale gray with greenish tint in color on polished surface. Megascopically several pyrite masses up to 2 mm in size are observed. Under the microscope, pyrite occurs as irregular shaped mass in larger grains and as round or granular shape in grains less than several hundred microns. They looks very fresh but some large grains are rimmed by goethite. Besides pyrite, tabular or fine irregular string shaped hematite-like minerals are observed.
922	P543	E4	Andestic tuff	The specimen is pale green andesitic tuff. At the edge of the polished specimen galena masses up to 500 microns in length are observed. Galena, clean white, is not replaced and associates with covellite. Tabular crystals of iron oxide, 50 × 250 microns in maximum and 20~30 × 100~150 microns in general size, are observed being scattered throughout the polished surface of the rock. They look like magnetite in their reflection color but show slightly anisotropism. There are some possibilities to be ilmenite. They are replaced by later goethite.

A. 1 · 4. Microphotographs of rocks and ores

Thin section

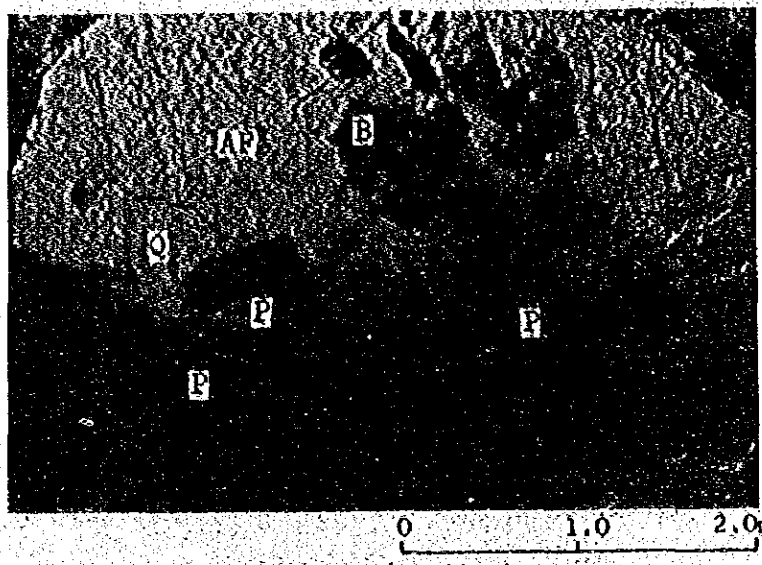
Sample No.	Field No.	Locality	Geological Unit	Rock Name
692	A318	10	CG	Granite
700	A333	20	MP	Quartz porphyry
705	A414	23	PU	Dolomite
738	I301	6	PU	Silicified Limestone
747	I327	11	PU	Limestone
754	L304	21	MP	Rhyolitic Tuff
766	L324	21	PU	Limestone
772	L347	6	PU	Dolomite
777	L377	22	PU	Zebra Dolomite
778	L379	22	PU	Limestone
781	L386	22	PU	Limestone
792	L454	10	PU	Sandstone
796	L481	10	CG	Gabbro
798	L497	10	TR	Welded Tuff
799	L503	22	PU	Dolomite
801	L526	9	PU	Dolomite
834	M493	4	PU	Limestone
841	P321	8	CG	Granite
842	P323	8	TR	Granite
852	P521	10	TR	Welded Tuff
855	P555	8	TR	Quartz porphyry
858	P563	8	PU	Chert
859	P565	8	TR	Quartz porphyry
867	S307	21	TR	Aplitic rock
892	A339	HC	TV	Granite

Sample No.	Field No.	Locality	Geological Unit	Rock Name
894	A386	SC	PU	Limestone
897	C379	RY	TV	Granodiorite
900	P457	HC	TV	Granite
901	P458	HC	TV	Andesite
903	A346	C13	PC	Diorite
909	A388	C14	M1	Rhyolite
916	L512	P4	MD	Monzonite
917	L514	P4	MD	Granodiorite
918	L516	P4	MD	Diorite
921	P541	E4	M1	Quartz porphyry
922	P543	E4	M1	Dolerite

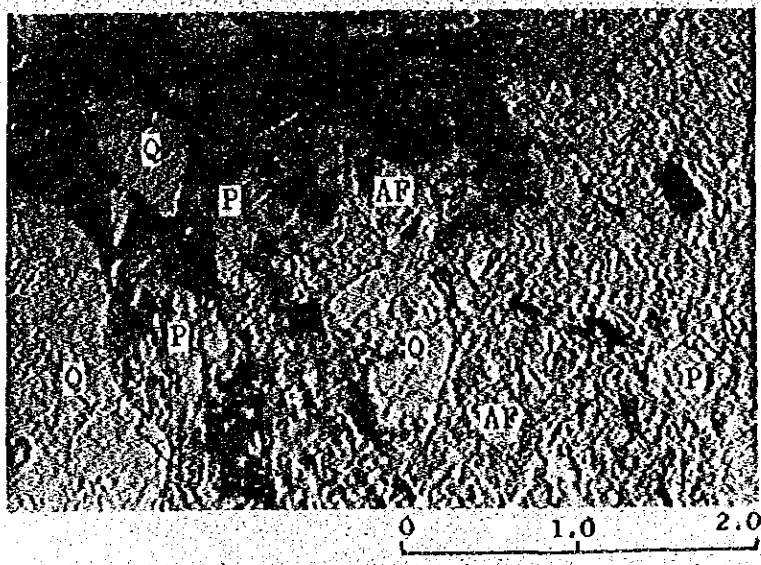
Abbreviations

o Minerals

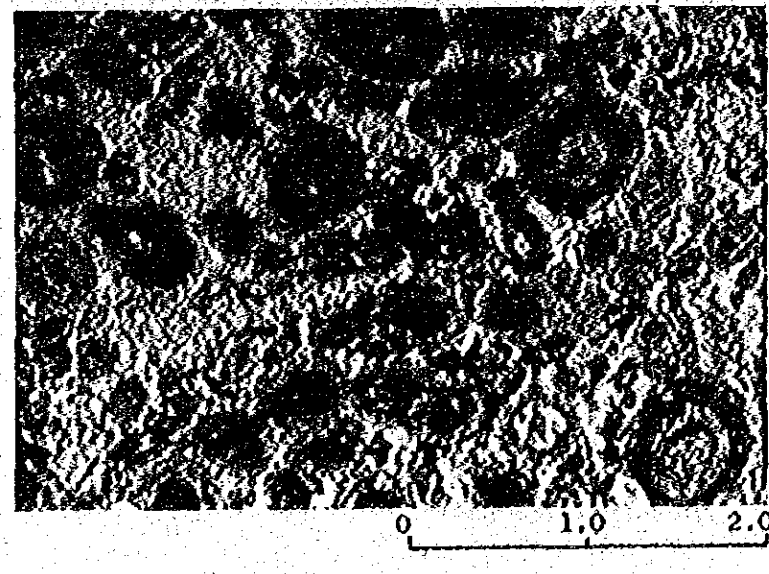
A : Augite	AF : Alkali feldspar	B : Biotite
C : Chlorite	F : Feldspar	H : Hornblende
M : Muscovite	O : Olivine	P : Plagioclase
Q : Quartz	S : Sericite	



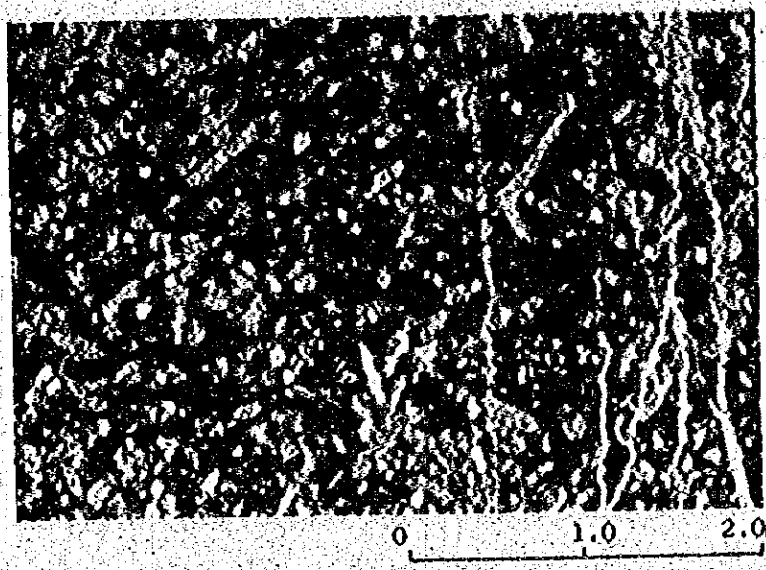
Sample No. 692
Field No. A318
Location. 10
Geological unit. CG
Rock name, Granite



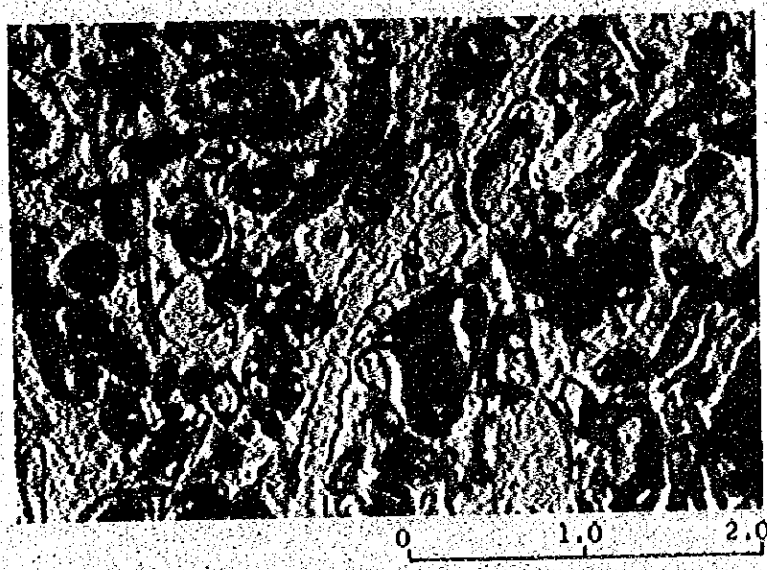
Sample No. 700
Field No. A333
Location. 20
Geological unit. MP
Rock name,
Quartz Porphyry



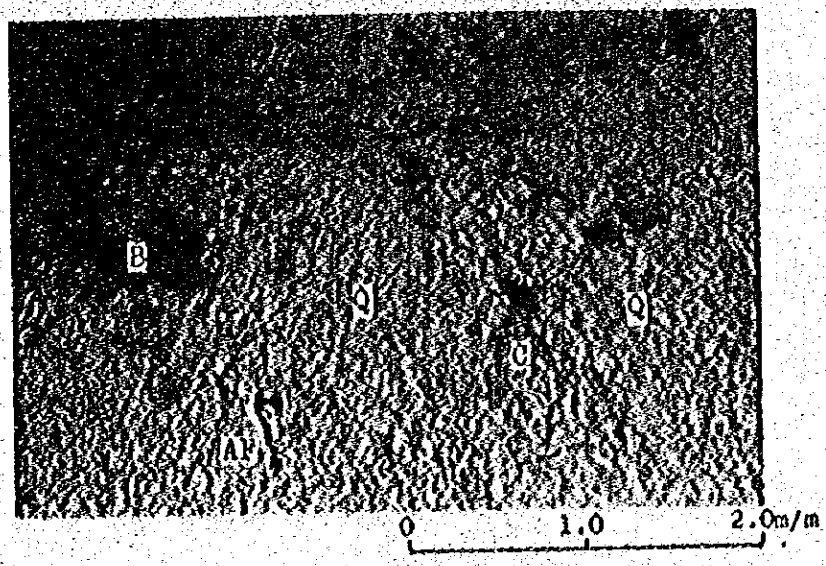
Sample No. 705
Field No. A414
Location. 23
Geological unit. PU
Rock name,
Dolomitized eosparite



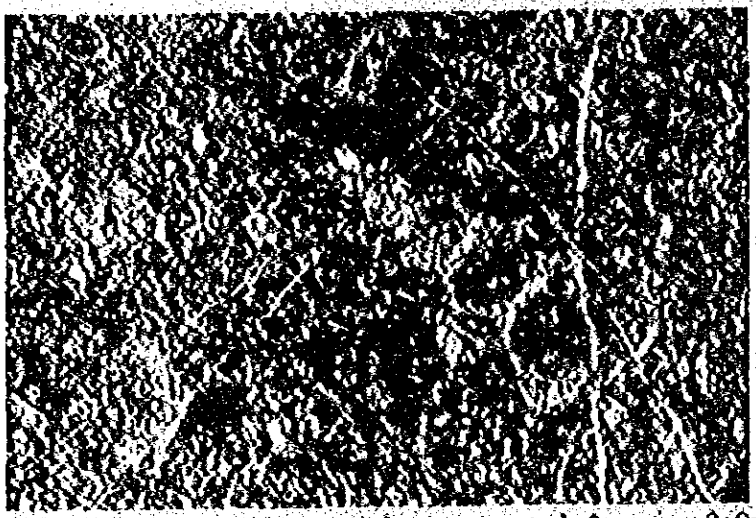
Sample No. 738
Field No. I301
Location. 6
Geological unit. PU
Rock name,
Muddy biomicrite
showing sponge spicules



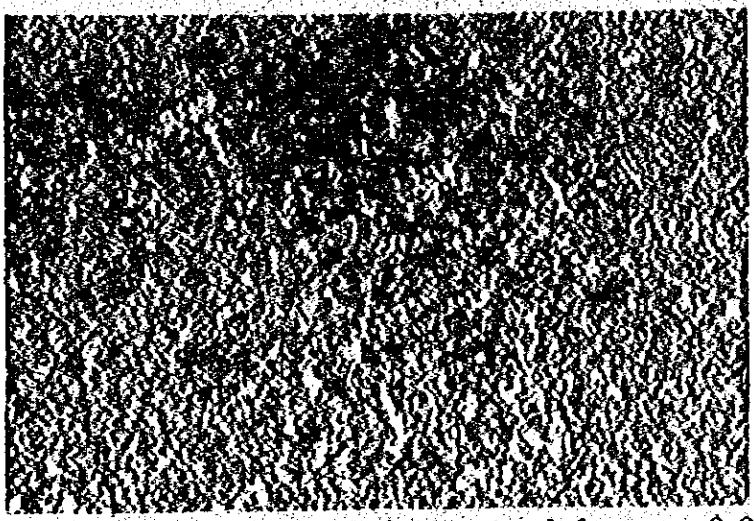
Sample No. 747
Field No. I327
Location. 11
Geological unit. PU
Rock name, Biosparite



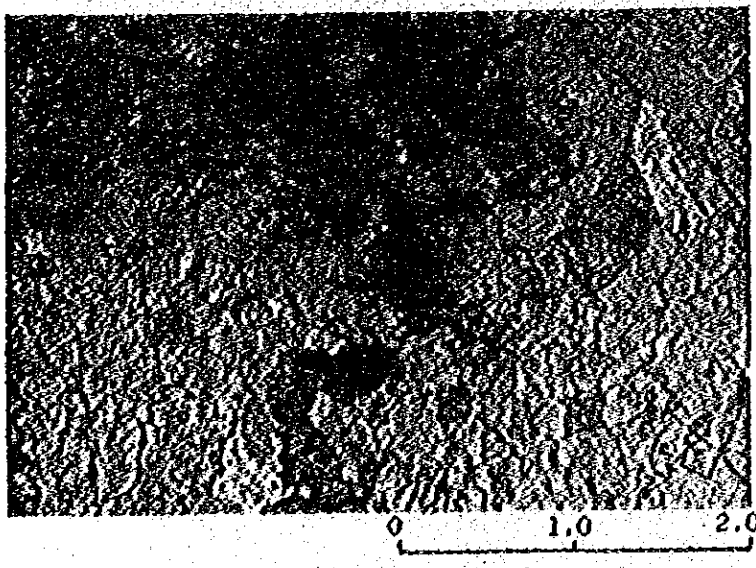
Sample No. 754
Field No. L304
Location. 21
Geological unit. MP
Rock name,
Rhyolitic tuff.



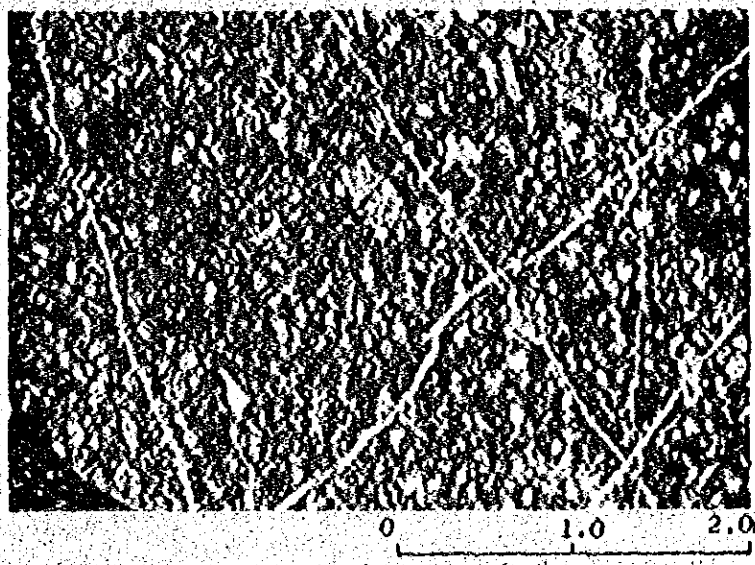
Sample No. 766
Field No. L324
Location. 21
Geological unit. PU
Rock name,
Fossiliferous muddy micrite including gastropod shell.



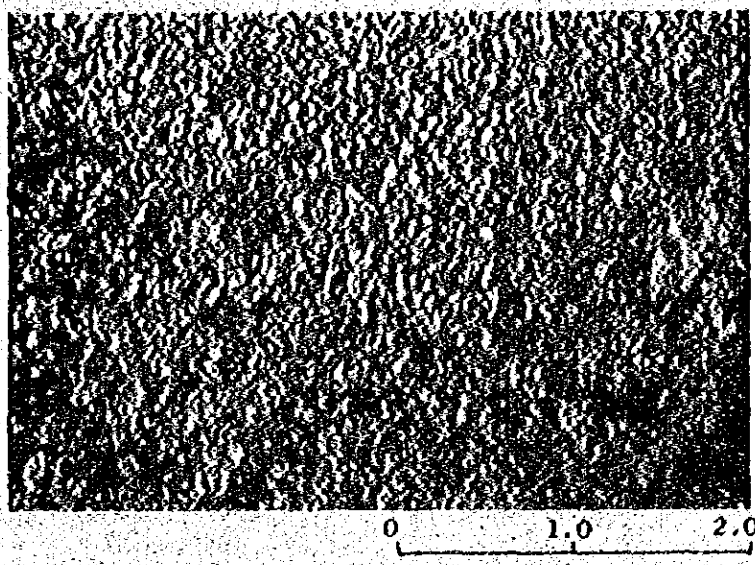
Sample No. 772
Field No. L347
Location. 6
Geological unit. PU
Rock name,
Fine crystalline dolomite



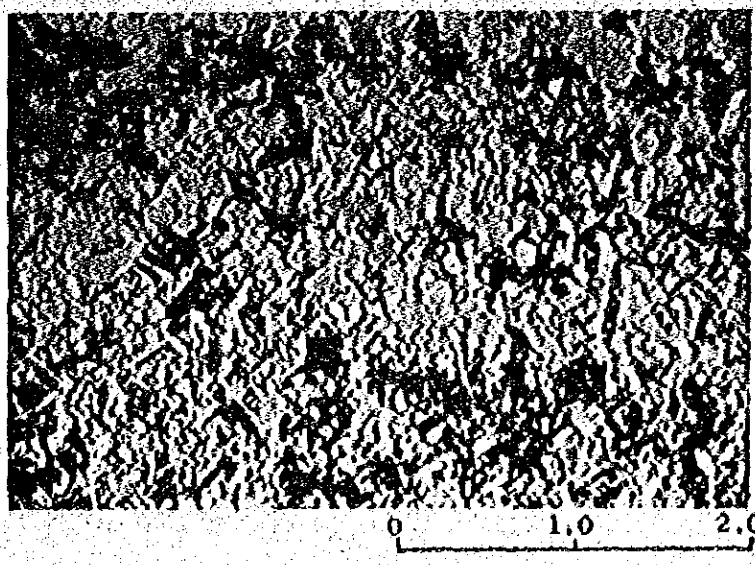
Sample No. 777
Field No. L377
Location. 22
Geological unit. PU
Rock name,
Medium grained crystalline dolomite (zebra dolomite)



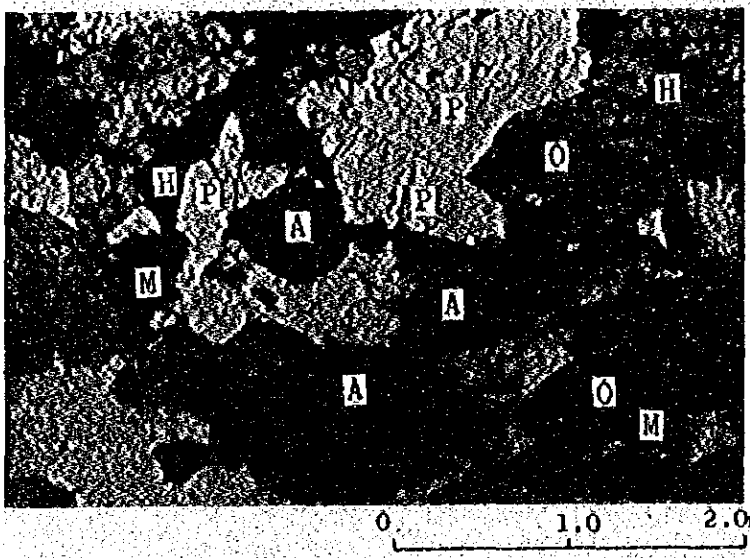
Sample No. 778
Field No. L379
Location. 22
Geological unit. PU
Rock name,
Portially dolomitized biomicrite



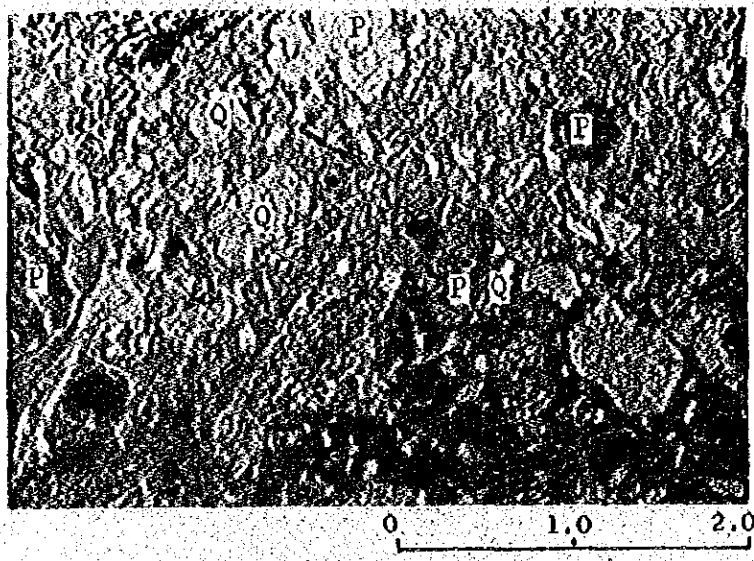
Sample No. 781
Field No. L386
Location. 22
Geological unit. PU
Rock name,
Radiolarian biomicrite



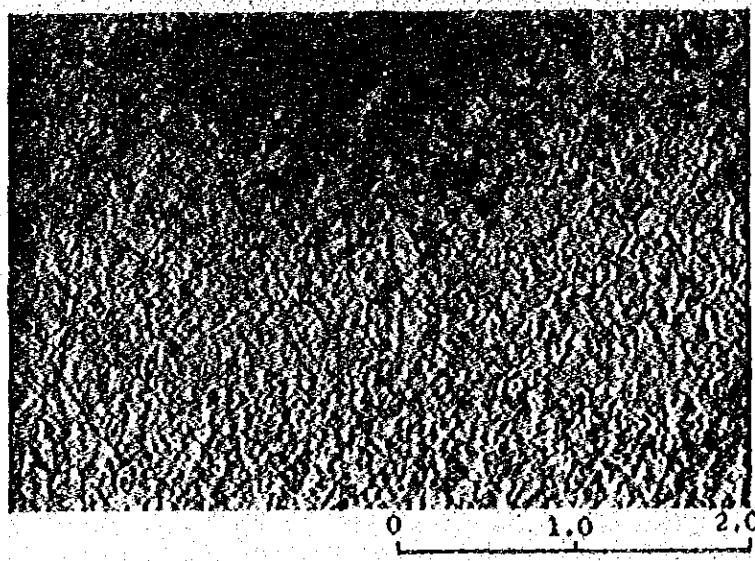
Sample No. 792
Field No. L454
Location. 10
Geological unit. PU
Rock name,
Medium grained quartzose sandstone.



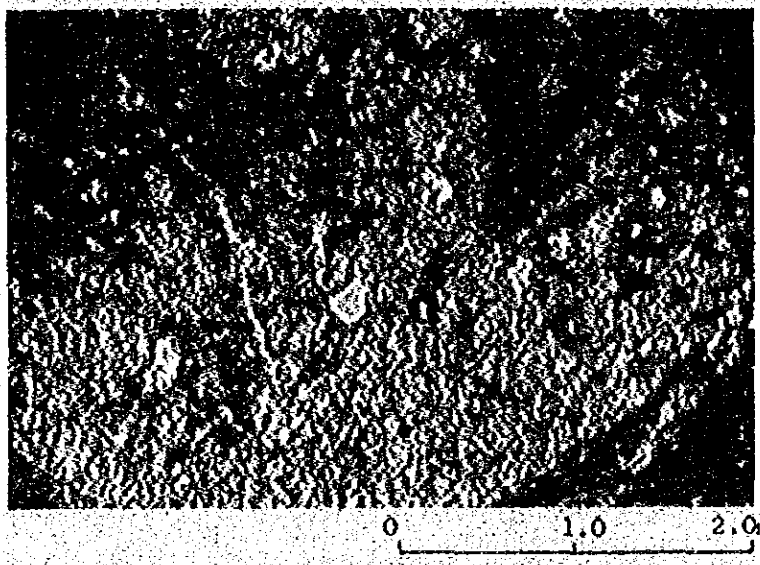
Sample No. 796
Field No. L481
Location. 10
Geological unit. CG
Rock name, Gabbro



Sample No. 798
Field No. L497
Location. 10
Geological unit. TR
Rock name, Welded tuff

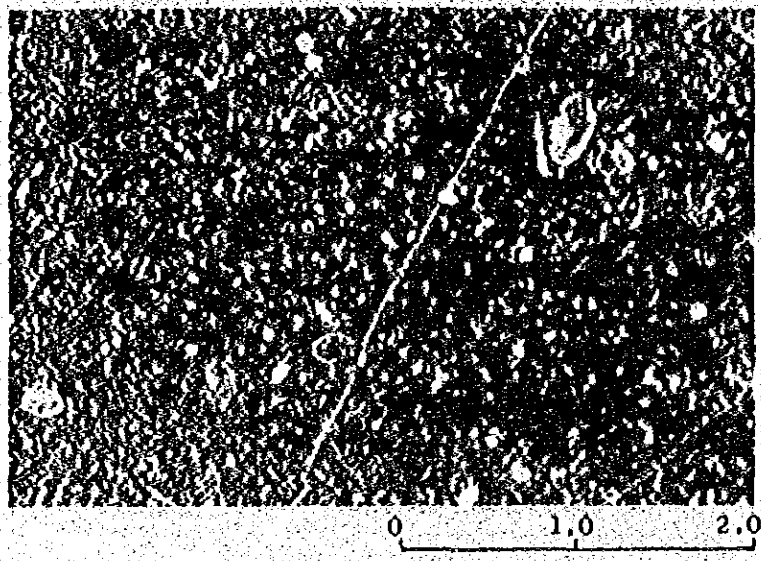


Sample No. 799
Field No. L503
Location. 22
Geological unit. PU
Rock name, Medium crystalline dolomite



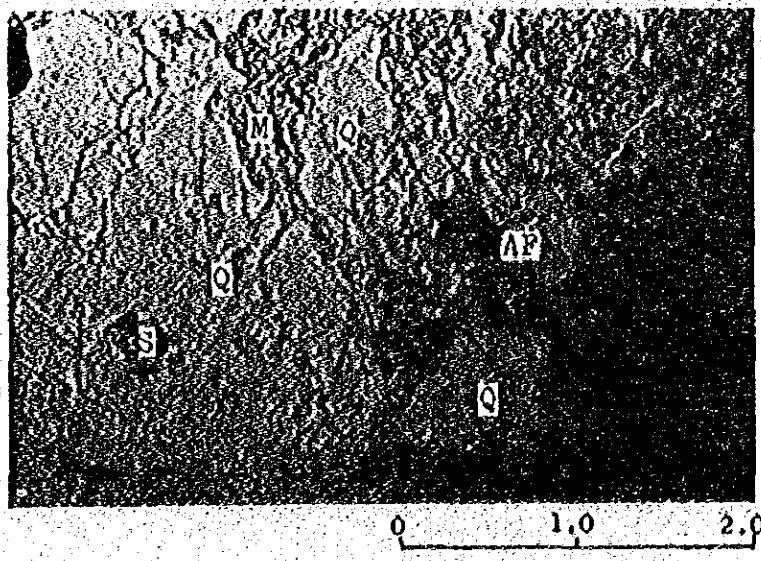
0 1.0 2.0m/m

Sample No. 801
Field No. L526
Location. 9
Geological unit. PU
Rock name,
Fine crystalline dolomite



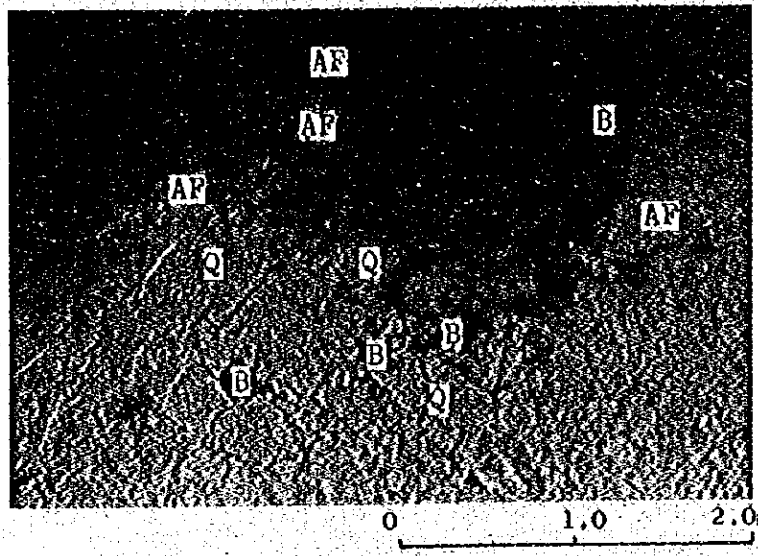
0 1.0 2.0m/m

Sample No. 834
Field No. M493
Location. 4
Geological unit. PU
Rock name,
Biomicrite including ostracods shells.

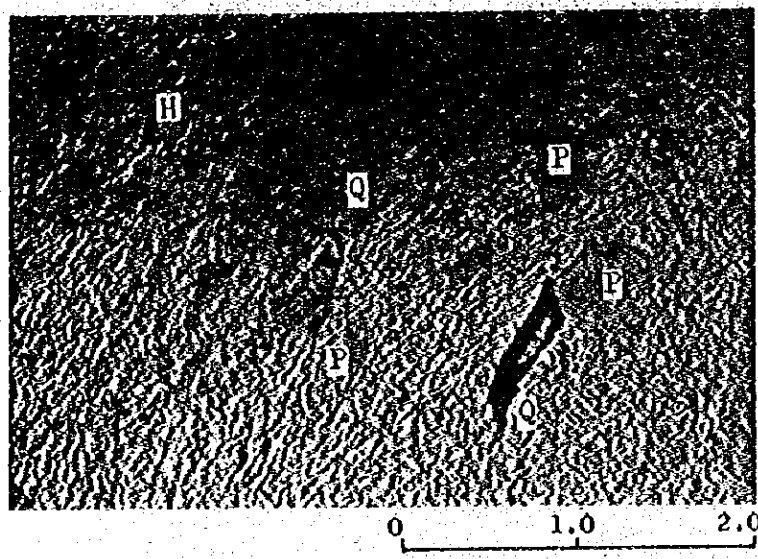


0 1.0 2.0m/m

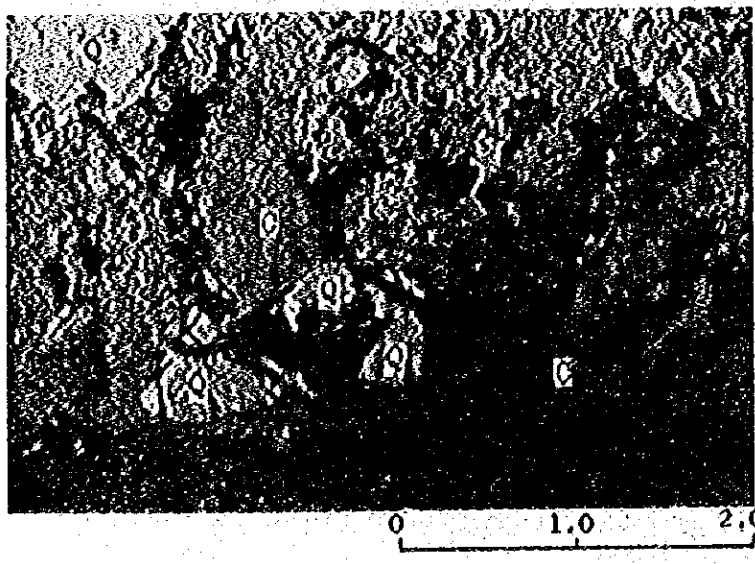
Sample No. 841
Field No. P321
Location. 8
Geological unit. CG
Rock name, Granite



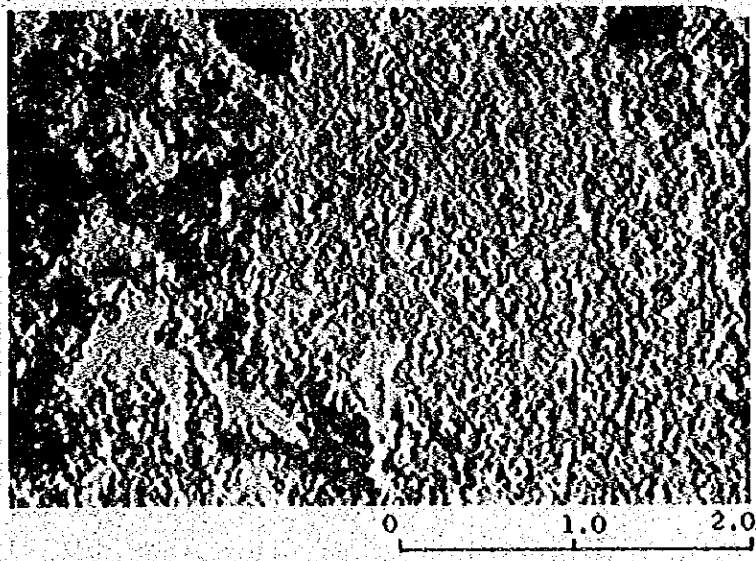
Sample No. 842
Field No. P323
Location. 8
Geological unit. TR
Rock name, Granite



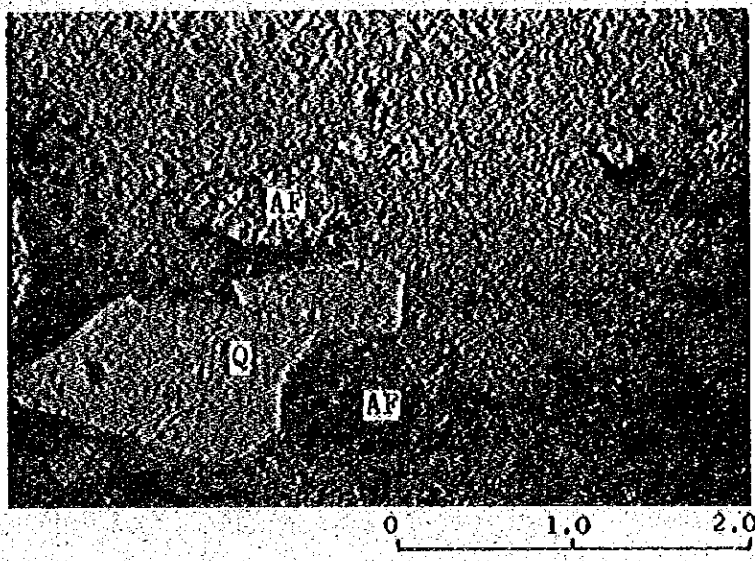
Sample No. 852
Field No. P521
Location. 10
Geological unit. TR
Rock name, Welded tuff



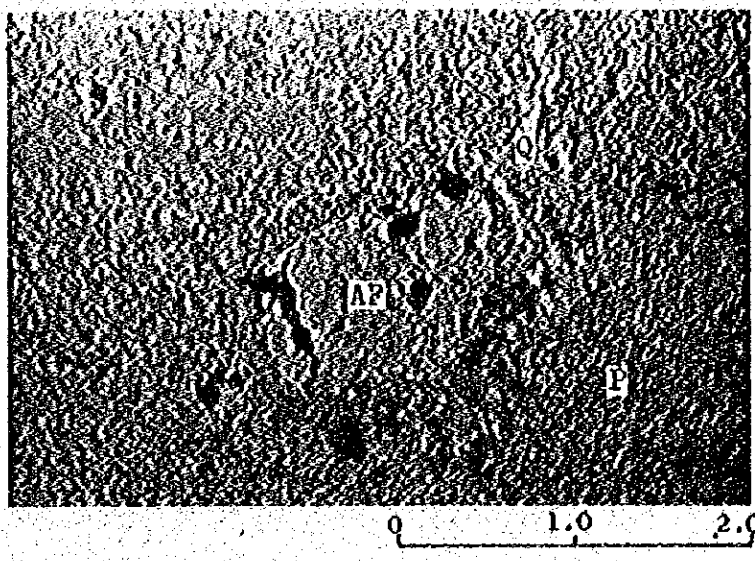
Sample No. 855
Field No. P555
Location. 8
Geological unit. TR
Rock name, Quartz porphyry



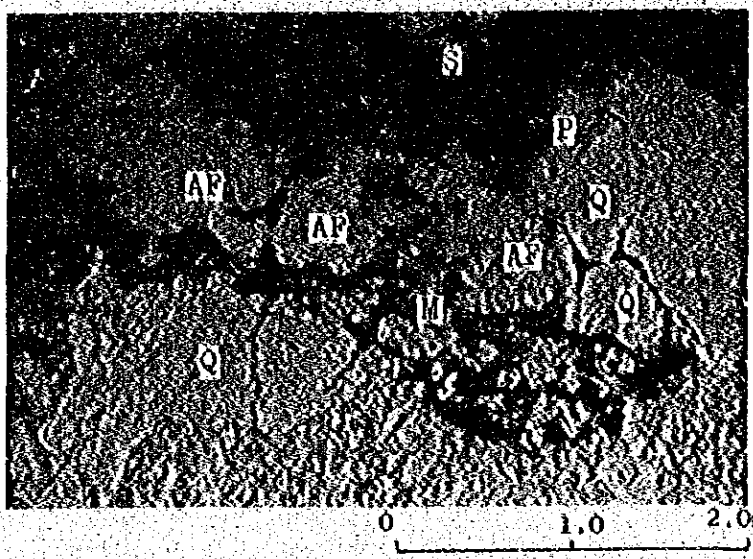
Sample No. 858
Field No. P563
Location. 8
Geological unit. PU
Rock name, Dolomitized chert



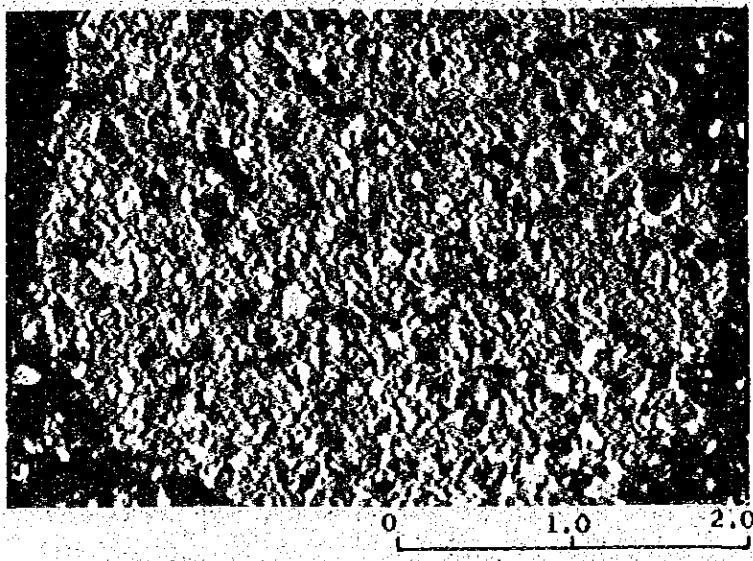
Sample No. 859
Field No. P565
Location. 8
Geological unit. TR
Rock name, Quartz porphyry



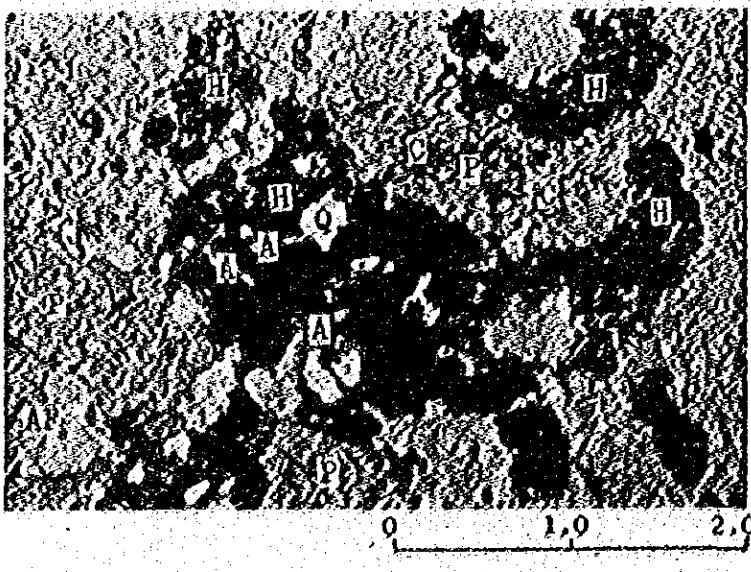
Sample No. 867
Field No. S307
Location. 21
Geological unit. TR
Rock name, Aplitic rock



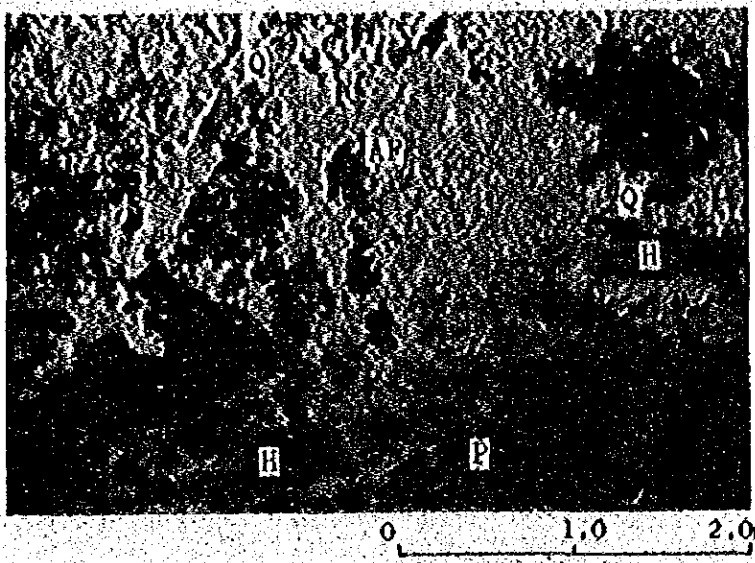
Sample No. 892
Field No. A339
Location. HO
Geological unit. TV
Rock name, Granite



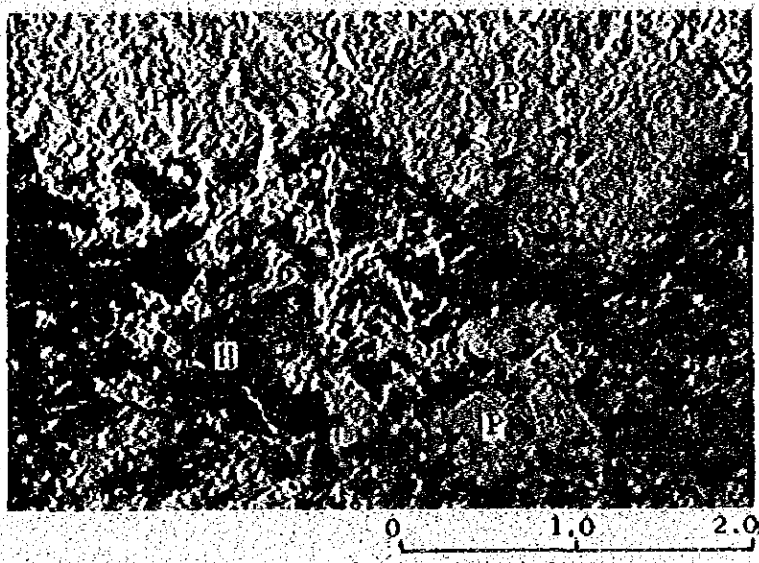
Sample No. 894
Field No. A386
Location. SC
Geological unit. PU
Rock name, Limestone



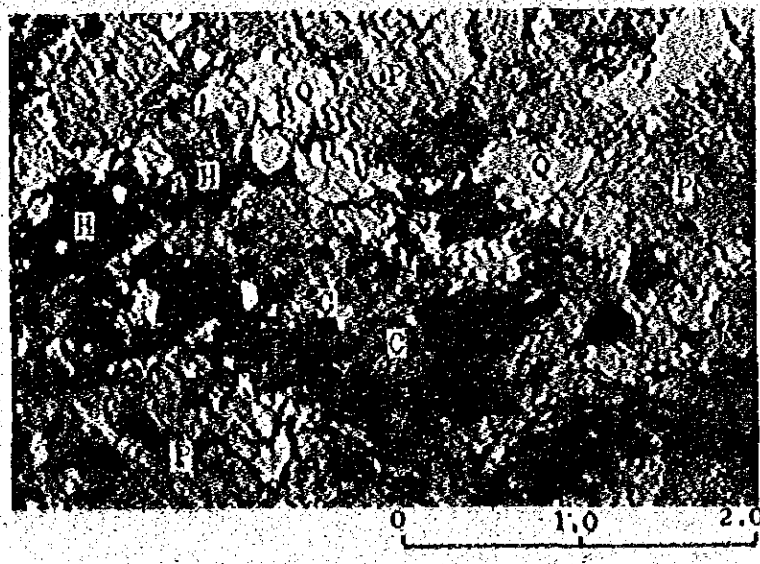
Sample No. 897
Field No. C379
Location. RY
Geological unit. TV
Rock name, Granodiorite



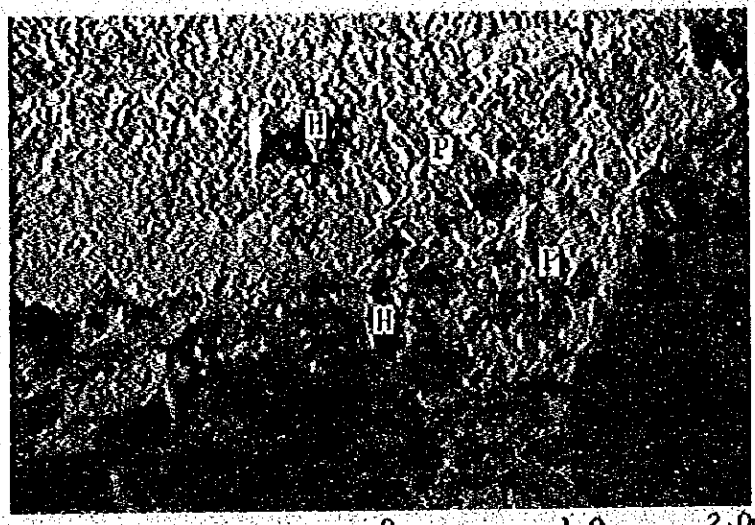
Sample No. 900
Field No. P457
Location. HC
Geological unit. TV
Rock name, Granite



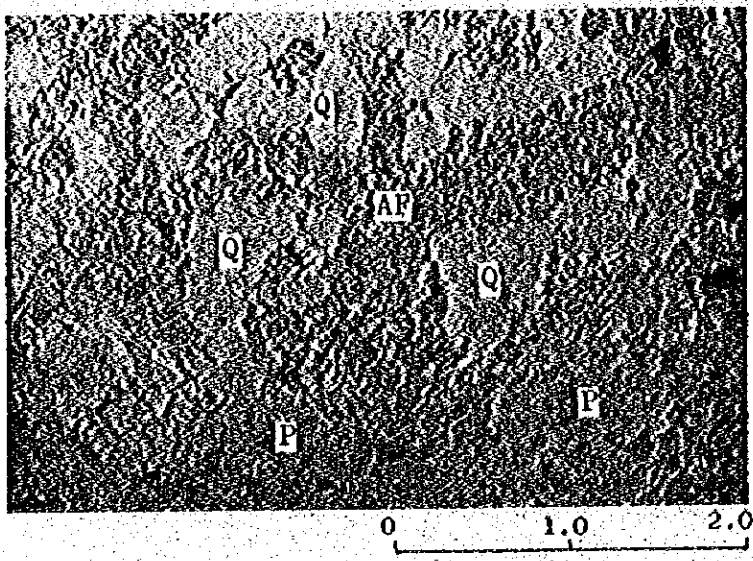
Sample No. 901
Field No. P458
Location. HC
Geological unit. TV
Rock name, Andesite



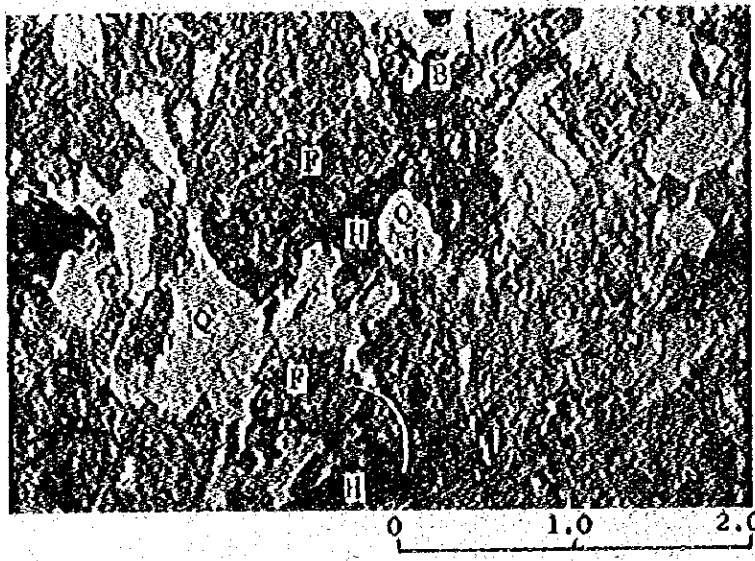
Sample No. 903
Field No. A346
Location. C13
Geological unit. PC
Rock name, Diorite



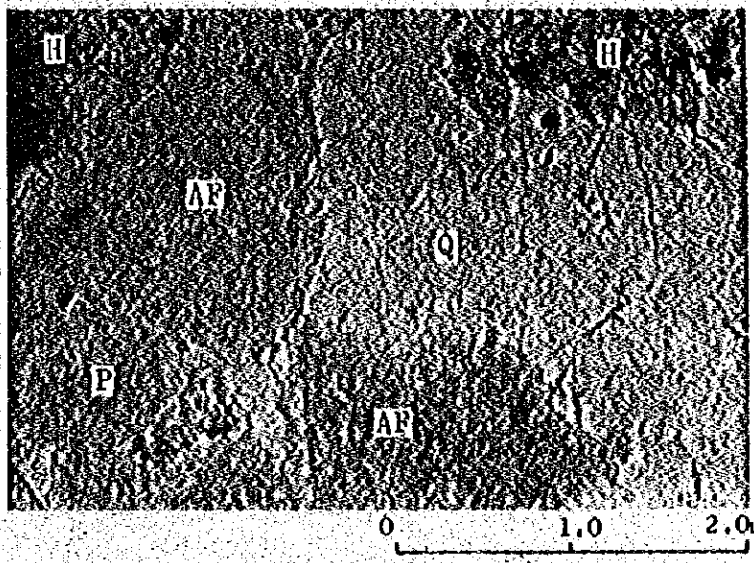
Sample No. 909
Field No. A388
Location. C14
Geological unit. MI
Rock name, Rhyolite



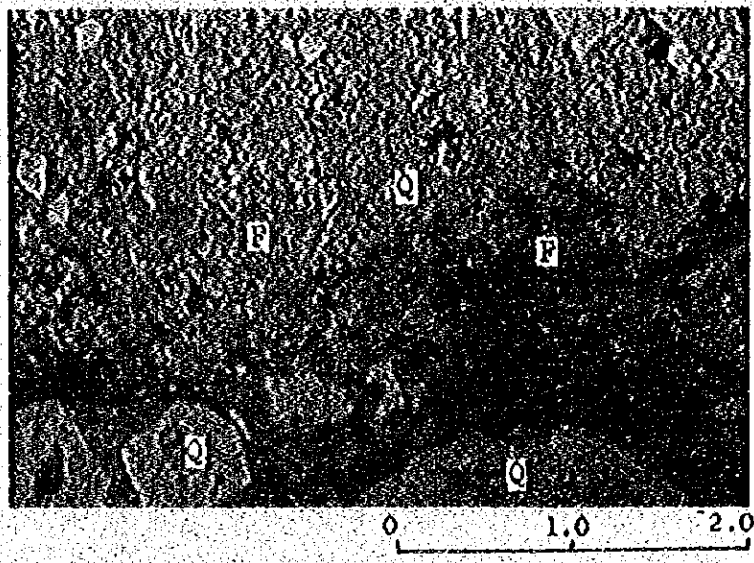
Sample No. 916
Field No. L512
Location. F4
Geological unit. MD
Rock name, Monzonite



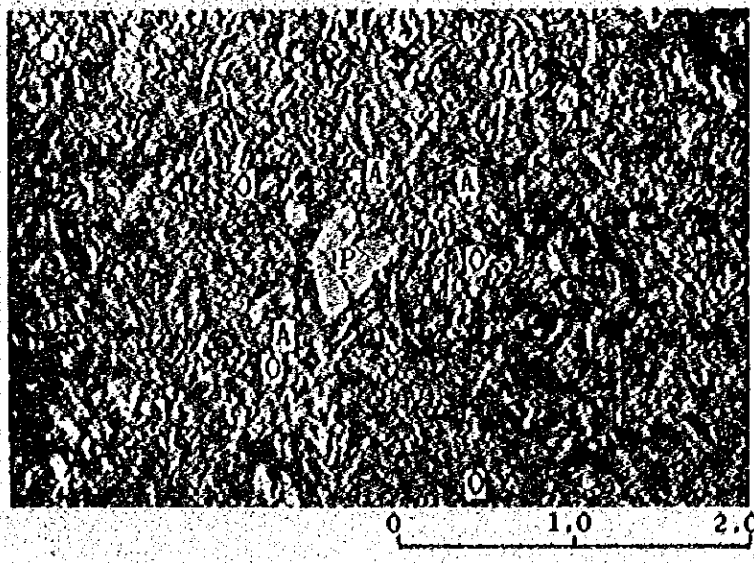
Sample No. 917
Field No. L514
Location. F4
Geological unit. MD
Rock name, Granodiorite



Sample No. 918
Field No. L516
Location. P4
Geological unit. MD
Rock name, Diorite



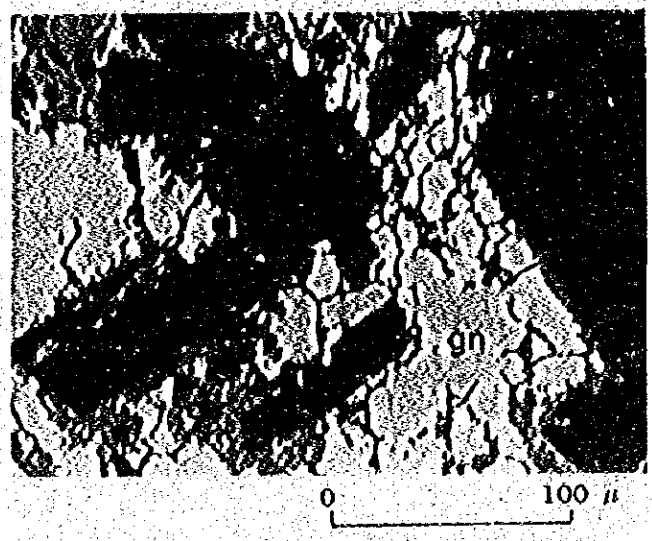
Sample No. 921
Field No. P541
Location. E4
Geological unit. MI
Rock name, Quartz porphyry



Sample No. 922
Field No. P543
Location. E4
Geological unit. MI
Rock name, Dolerite

Polished Section

Sample No.	Field No.	Locality	Rock Name
731	C416	21	Galena bearing limestone
755	L305	21	Limestone
762	L319	21	Limestone
763	L320	21	Limestone
766	L324	21	Limestone
775	L364	22	Dolomite
786	L416	11	Dolomite showing zebra structure
799	L503	22	Dolomite showing zebra structure
835	M494	4	Dolomite
836	M495	4	Dolomite
863	P588	8	Limestone
869	S310	21	Dolomite
875	S322B	21	Galena bearing limestone
881	S343	22	Sphalerite in zebra dolomite
883	S346	22	Sphalerite in zebra dolomite
888	S351	22	Sphalerite in zebra dolomite

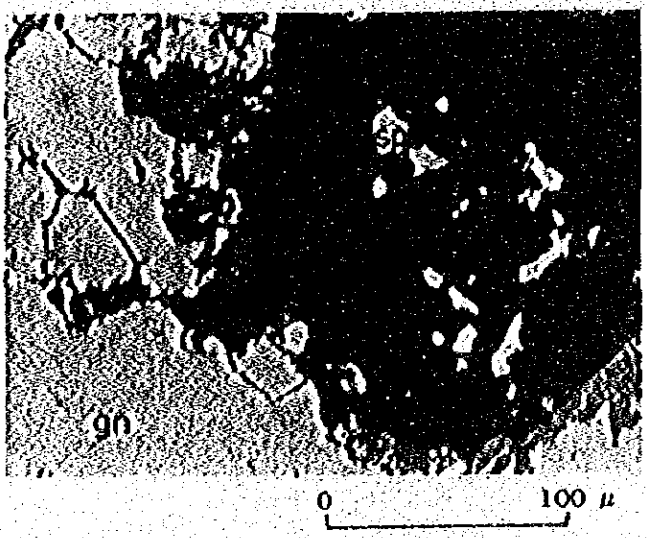


Sample C-416

Galena replaced by network of cerussite.

gn : galena

cer : cerussite



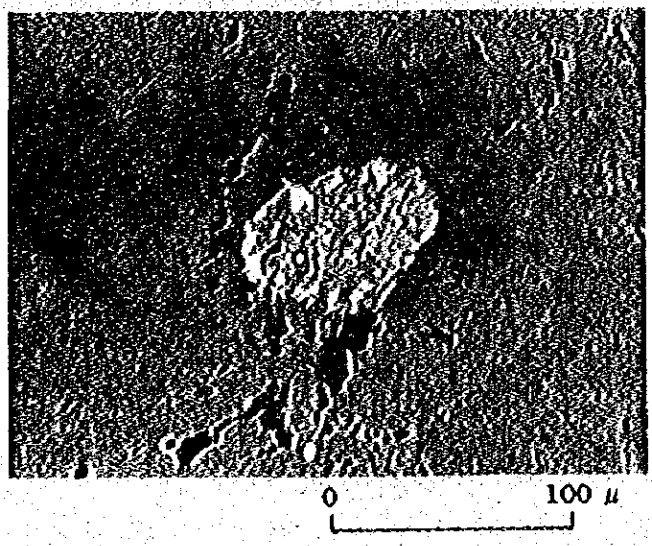
Sample C-416

Fine disseminated grains of sphalerite and galena replaced by cerussite.

gn : galena

cer : cerussite

sp : sphalerite



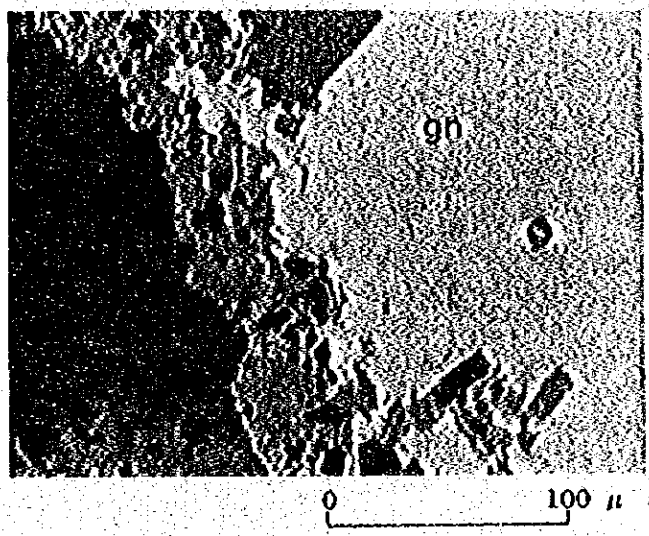
Sample C-416

Iron oxide grain (hematite and goethite?) containing tiny relict pyrite.

hm : hematite

gt : goethite

py : pyrite

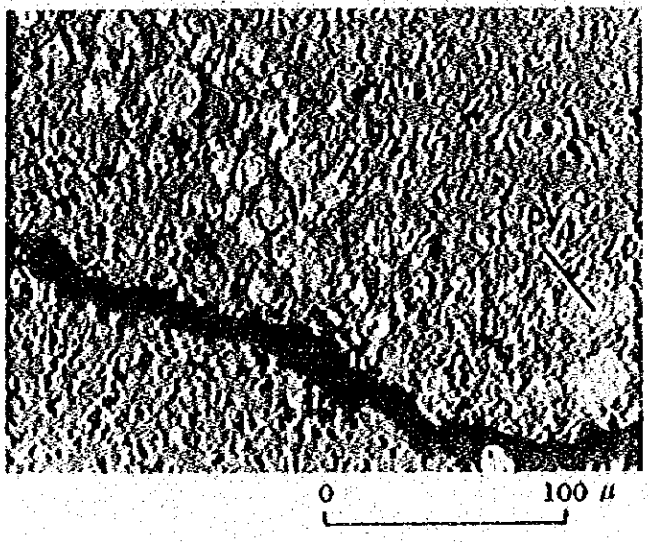


Sample L-305

Galena replaced by cerussite.

gn : galena

cer : cerussite

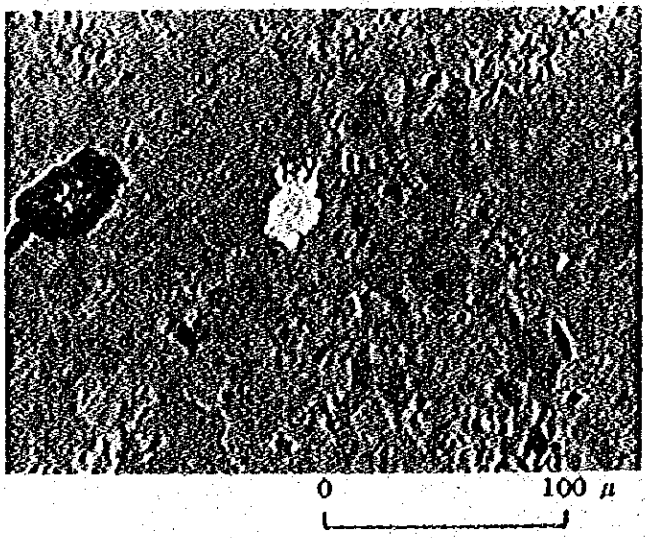


Sample L-305

Iron hydroxide veinlet composed by goethite spherulites along a crack. Pyrite recognized at the center of some goethite.

gt : goethite

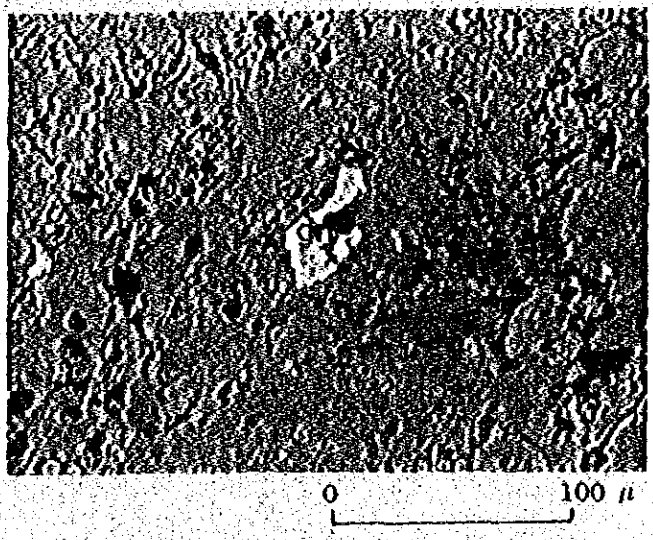
py : pyrite



Sample L-319

An aggregate of fine pyrite.

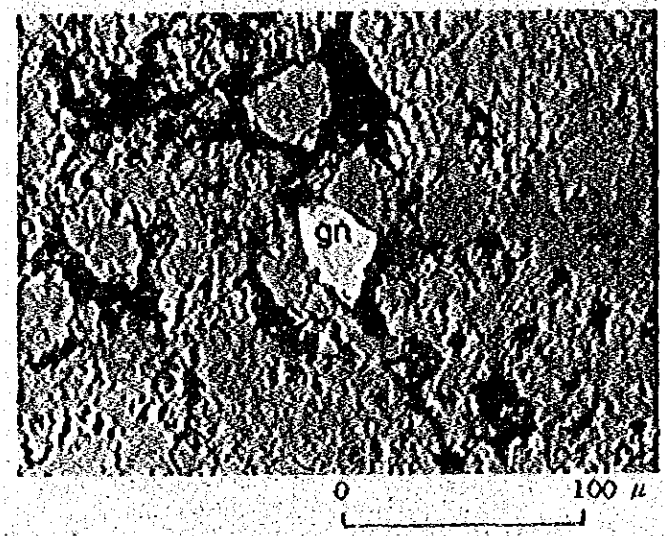
py : pyrite



Sample L-320

Small galena grains.

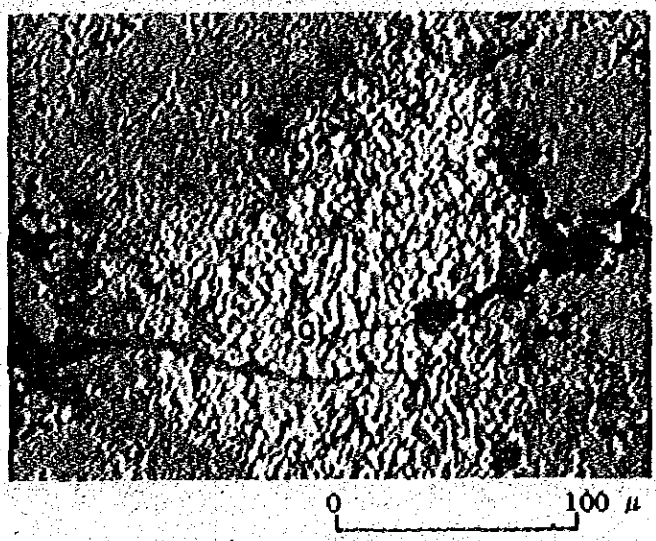
gn : galena



Sample L-320

Galena crystal in a fine crack.

gn : galena

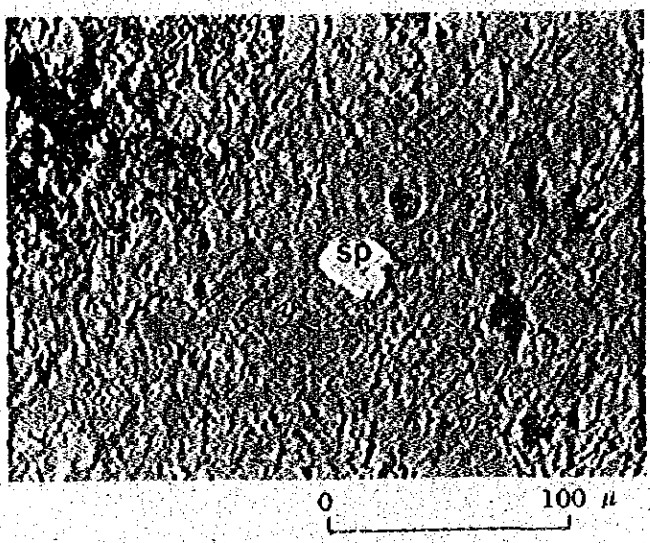


Sample L-320

Fine disseminated spherical goethite with tiny pyrite.

gt : goethite

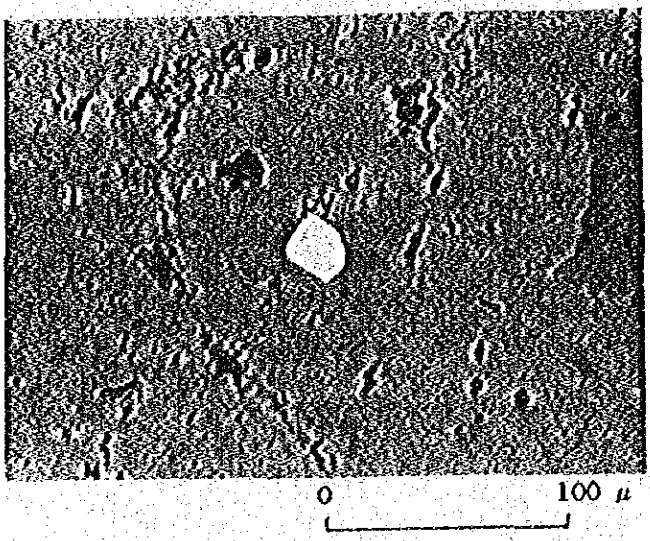
py : pyrite



Sample L-324

Fine sphalerite grain.

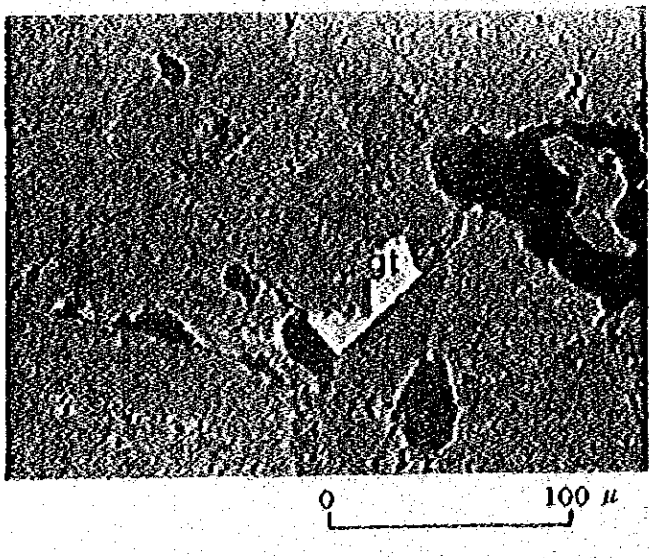
sp : sphalerite



Sample L-364

Idiomorphic pyrite cube crystal.

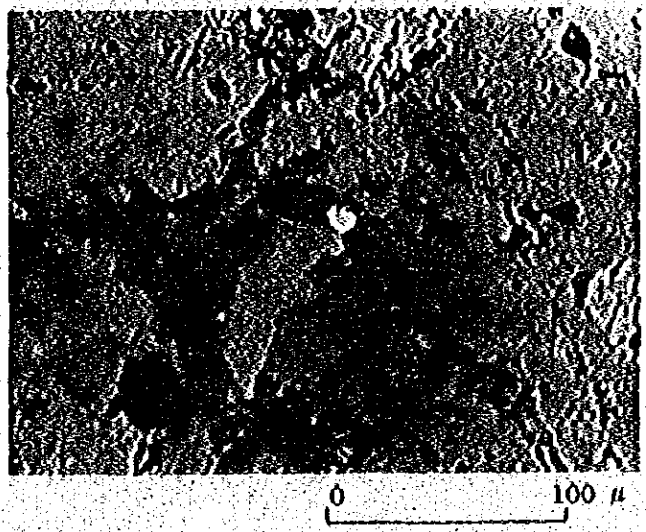
py : pyrite



Sample L-364

Small goethite grain.

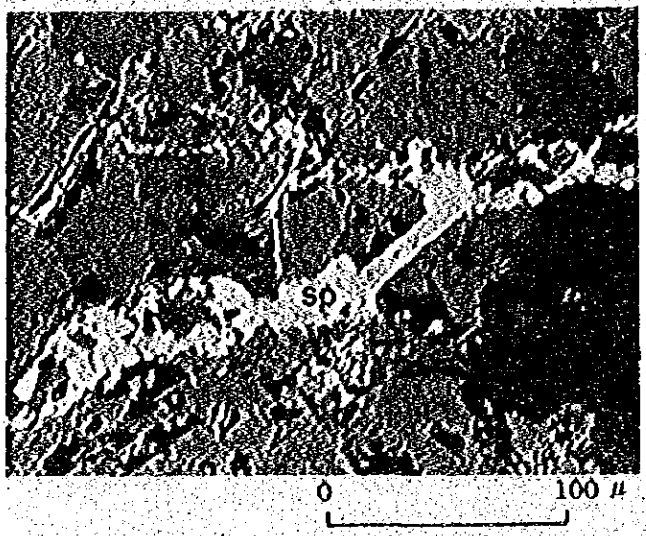
gt : goethite



Sample L-503

Fine sphalerite grain.

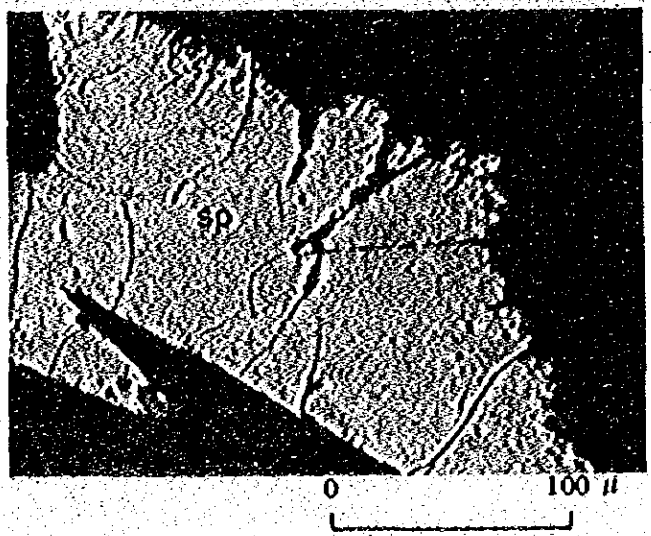
sp : sphalerite



Sample L-416

Sphalerite veinlet in dolomite.

sp : sphalerite

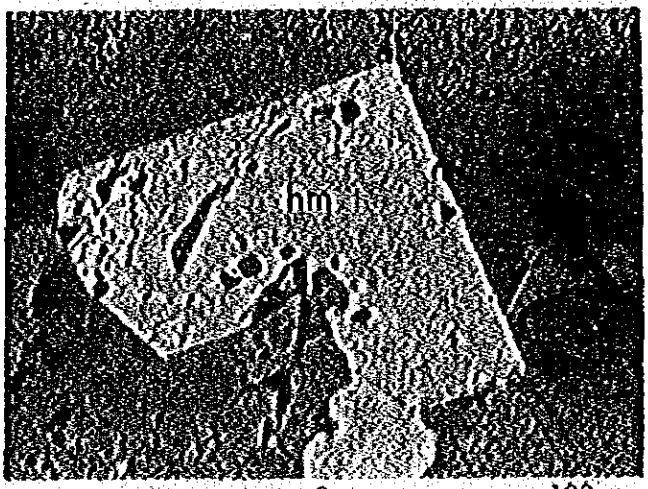


Sample L-416

Sphalerite partially replaced by smithsonite.

sp : sphalerite

sm : smithsonite

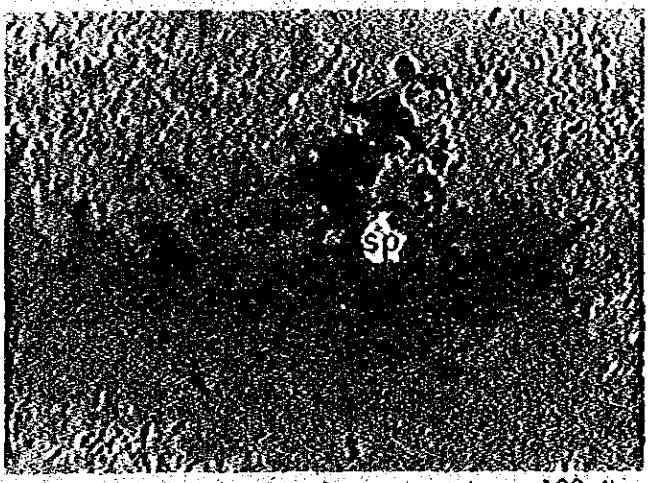


Sample L-416

Hematite rimmed by thin goethite.

hm : hematite

gt : goethite

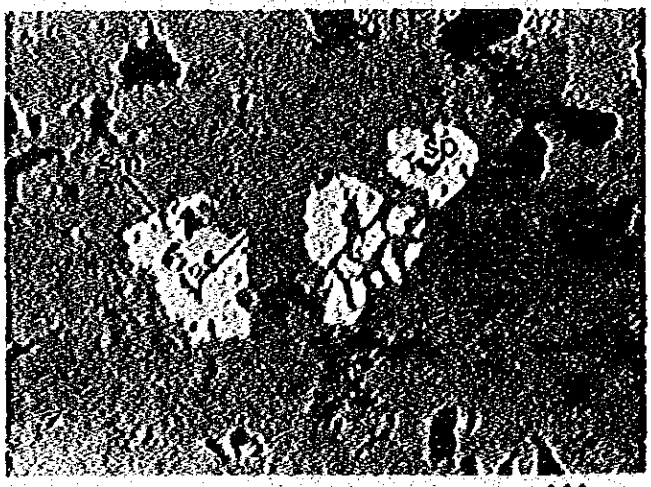


Sample M-494

Small sphalerite grain beside coarse grain veinlet of carbonate.

sp : sphalerite

coa-v : coarse grain carbonate veinlet

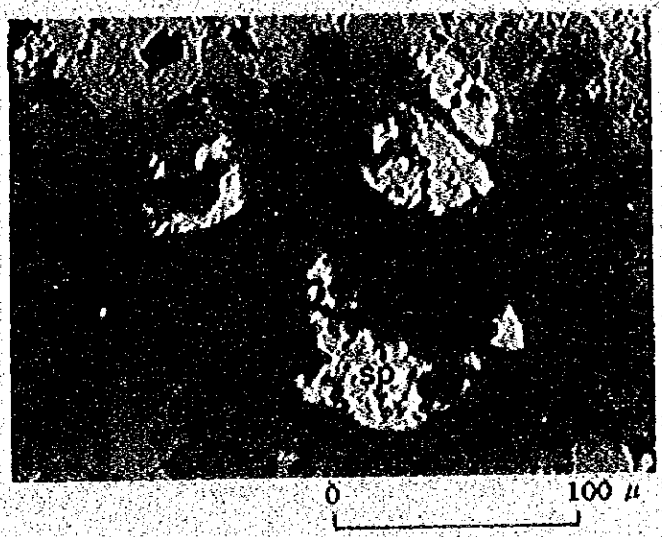


Sample M-495

Sphalerite grains replaced by smithsonite partly.

sp : sphalerite

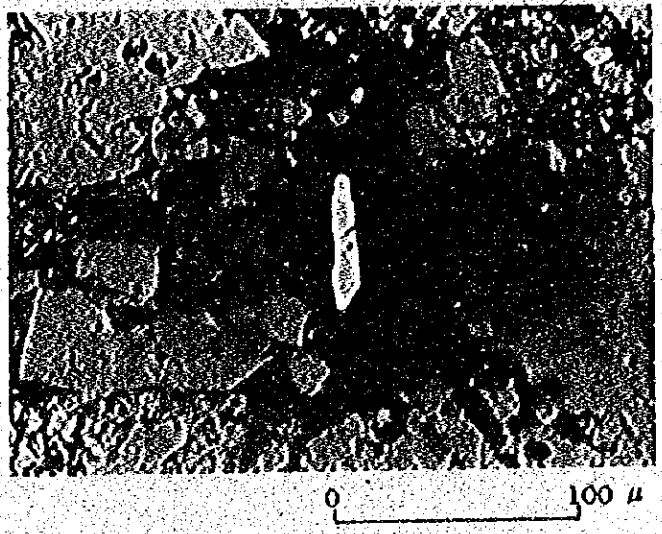
sm : smithsonite



Sample M-495

Sphalerite grains replaced by smithsonite.

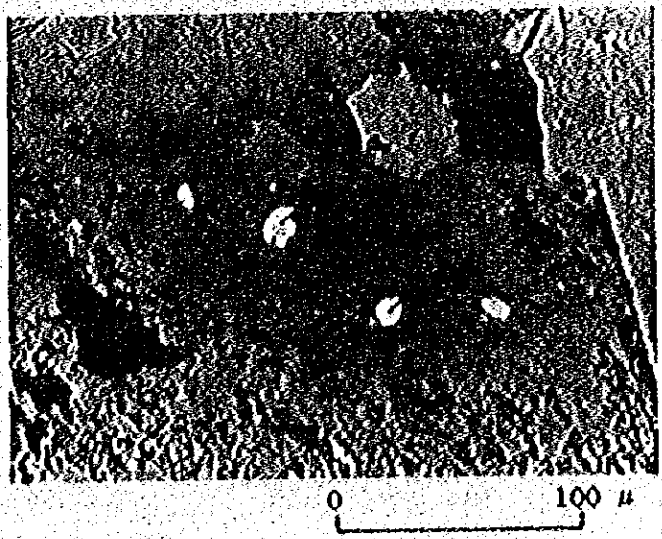
sp : sphalerite
sm : smithsonite



Sample P-588

Galena grain in the hole of porous limestone.

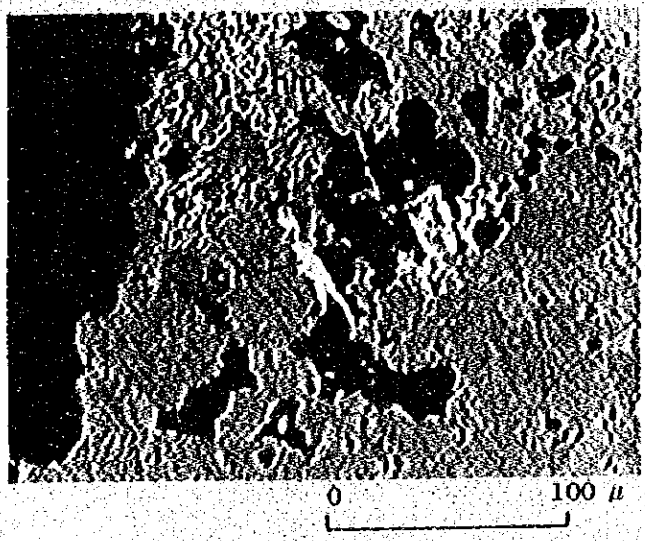
gn : galena



Sample S-310

Pyrite and galena grains.

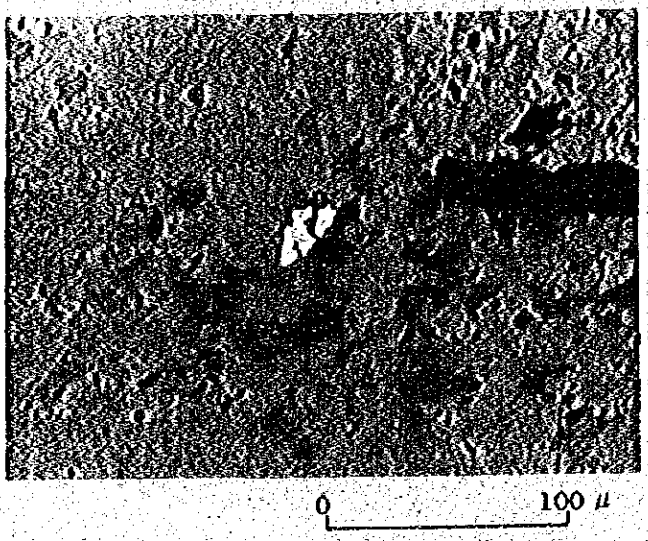
py : pyrite
gn : galena



Sample S-322-B

Small galena and snake-like hematite.

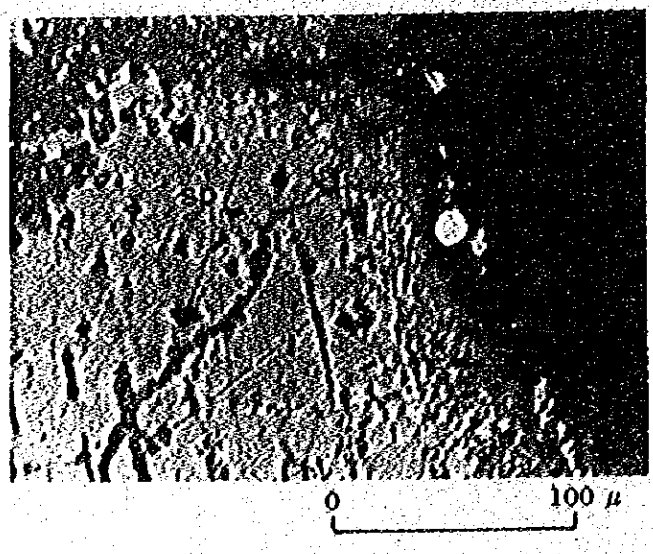
gn : galena
hm : hematite



Sample S-322 B

Fine sphalerite grains.

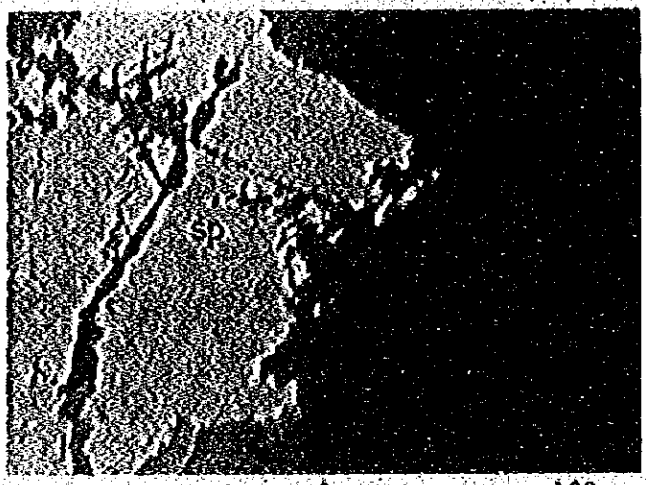
sp : sphalerite



Sample S-346

Sphalerite with smithsonite and fine pyrite grains.

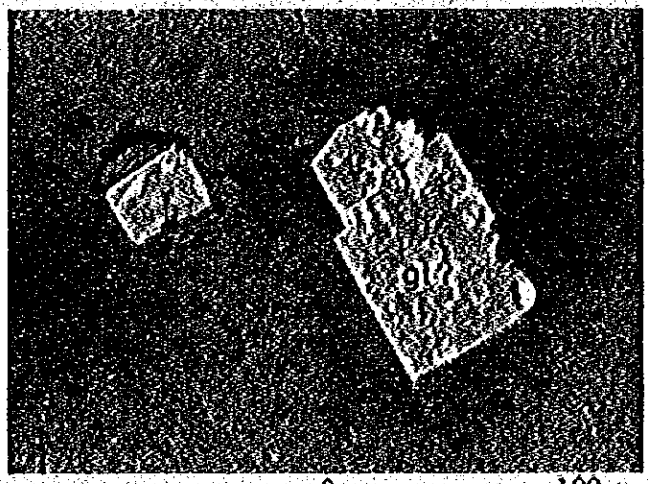
sp : sphalerite
sm : smithsonite
py : pyrite



Sample S-343

Sphalerite replaced by smithsonite.

sp : sphalerite
sm : smithsonite



Sample S-343

Iron hydroxide (goethite?) grains with relict pyrite.

gt? : goethite?
py : pyrite

Sample S-351

Sphalerite replaced in lattice shape by smithsonite.

sp : sphalerite
sm : smithsonite

A. I - 5. Chemical composition of ore samples

Sample No.	Field No.	Analysis				Location	Remarks
		Cu %	Pb %	Total Zn %	Non sulphide Zn %		
729	C413	0.02	0.40	0.02		21	Limonitized limestone of the old gallery in San Roque (Pucara Group)
730	C414	0.02	0.06	0.27		21	Limonitized limestone of the old gallery in San Roque (Pucara Group)
731	C416	0.02	2.48	0.42		21	Galena ore disseminated in limestone of San Roque (Pucara Group)
835	M494	0.01	0.22	0.28		4	Galena minute crystal bearing limestone (Pucara Group)
856	P556	0.03	0.11	0.25		8	Sheared zone between intrusive body and limestone in old gallery of the Chontabamba district (Pucara Group)
860	P579	0.04	0.10	0.29		8	Limonitized limestone containing calcite pods in old gallery of Chontabamba (Pucara Group)
861	P584	0.01	0.17	0.36		8	Ditto
862	P586	0.02	0.34	0.46		8	Ditto
864	P590	0.01	0.09	0.14		8	Ditto
879	S327	0.03	0.50	0.27		21	Galena minute crystal bearing limestone (Pucara Group)
882	S345	0.02	0.01	0.029	0.023	22	Non mineralized dolomite of Tambo Maria (Pucara Group)
883	S346	0.02	0.02	25.90	25.25	22	Sphalerite bearing dolomite of Tambo Maria (Pucara Group)
884	S347	0.02	0.01	3.05	3.02	22	Non mineralized dolomite of Tambo Maria (Pucara Group)
885	S348	0.01	0.01	0.108	0.079	22	Ditto (Pucara Group)
886	S349	0.01	0.01	0.043	0.020	22	Ditto (Pucara Group)
887	S350	0.03	0.02	3.00	1.90	22	Sphalerite bearing dolomite of Tambo Maria (Pucara Group)
888	S351	0.01	0.02	9.60	2.47	22	Ditto (Pucara Group)
889	S352	0.03	0.02	0.040	0.016	22	Non mineralized dolomite of Tambo Maria (Pucara Group)
905	A357	0.03	0.06	0.130		C14	Limonitized limestone in the Rio Huallaga (Pucara Group)

A. I - 6. Chemical and normative composition of igneous rocks

Sample No.	728	855	903	916	917
Field No.	C-411	P-555	A-316	L-512	L-514
Rock Name	QUARTZ PORPHYRY	QUARTZ PORPHYRY	DIORITE	MONZONITE	GRANODIORITE
Locality	4	8	C13	F4	P4
(Chemical Composition)	WT.%				
SiO_2	78.56	73.59	54.89	78.83	59.71
TiO_2	0.18	0.17	0.96	0.06	0.79
Al_2O_3	11.50	10.59	17.42	12.73	14.91
Fe_2O_3	1.43	1.17	2.13	0.66	2.43
FeO	0.23	0.23	6.50	0.23	6.37
MnO	0.01	0.07	0.16	0.02	0.18
MgO	0	0.06	4.46	0.07	5.15
Na_2O	2.55	0	2.42	2.59	2.60
K_2O	4.59	4.16	1.66	4.03	1.19
H_2O (-)	0.41	1.31	2.20	0.80	2.21
H_2O (+)	0.36	0.54	0.22	0.54	0.57
P_2O_5	0.03	0.07	0.19	0.15	0.15
CaO	0.09	7.29	6.14	0.21	4.45
Total	99.94	99.25	99.35	100.92	100.71
MgO	0	1.35	29.65	1.01	33.64
FeO	3.12	5.17	43.22	3.32	41.61
$(Na, K)_2O$	96.88	93.48	27.13	95.66	24.76
(Normative Composition)					
Q	46.44	47.52	11.50	48.42	19.68
C	2.26	0	0.96	4.10	1.65
Or	27.35	25.24	10.12	23.91	7.18
Ab	21.76	0	21.12	22.01	22.46
An	0.25	17.05	30.14	0.06	21.54
Di-Wo	0	0.18	0	0	0
Di-En	0	0.15	0	0	0
Hy-En	0	0	0	0.18	13.10
Hy-Fs	0	0	11.46	0	8.90
Mt	0.25	0.49	9.17	0.64	3.60
Hm	1.27	0.86	3.19	0.22	0
Il	0.34	0.33	0	0.11	1.53
Ap	0.07	0.17	1.88	0.35	0.35
Wo	0	8.01	0.45	0	0
Total	100.00	100.00	100.00	100.00	100.01

A. I - 7. Radiometric age of igneous rocks

Sample No.	Field No.	Rock Name	Locality	Mineral	$Ar^{40}R/K^{40}$	AGe (m.y.)	Argon analyses			Potassium analyses		
							$Ar^{40}R$, ppm	$Ar^{40}R$/Total Ar^{40}	Ave. Ar^{40}, ppm	K, %	Ave. K, %	K^{40}, ppm
728	C411	Quartz porphyry	4	Feldspar	0.009317	153 ± 6	0.03928 0.03726	0.500 0.489	0.03827	3.387 3.347	3.367	4.107
855	F555	Quartz porphyry	8	Feldspar	0.01809	286 ± 14	0.01144 0.01112	0.306 0.279	0.01128	0.508 0.514	0.511	0.623
916	L512	Monzonite	F4	Muscovite	0.01944	306 ± 11	0.1435 0.1453	0.911 0.887	0.1444	6.130 6.047	6.088	7.427

Constants Used

$\lambda\beta$ = 4.72 x 10^{-10}/year

λe = 0.585 x 10^{-10}/year

K^{40}/K = 1.22 x 10^{-2} atom.%

$$\text{Age} = \frac{1}{\lambda e + \lambda\beta} \ell n \left[\frac{\lambda\beta + \lambda e}{\lambda e} \times \frac{Ar^{40}R}{K^{40}} + 1 \right]$$

Note : $Ar^{40}R$ refers to radiogenic Ar^{40}.

m.y. refers to millions of years.

A. 1 - 8. List of fossils

Sample No.	Location	Stratigraphical Units	Fossils	Estimated Age	Remarks
A 323	6	Pucara Group	Gastropods	Jurassic	Gastropods
			Echinoids	Jurassic	Echinoids
A 340	20	Pucara Group	Echinoids spine	Jurassic	Echinoids spine
			Mollusc shells	Jurassic	Mollusc shells
A 345	C13	Pucara Group	Mollusc shells	Jurassic	Mollusc shells
A 359	C14	Pucara Group	Mollusc shells	Jurassic	Mollusc shells
A 363	C13	Pucara Group	Echinoids spine	Jurassic	Echinoids spine
A 376	B17	Pucara Group	Astarte sp.	Jurassic-Recent	Bivalves
			Crinoids stem	Jurassic-Recent	Crinoids stem
			Sponge spicule	Jurassic-Recent	Sponge spicule
C 322	22	Pucara Group	Epammonites sp.	Lower Jurassic-Sinemurian	Ammonitoe
			Camptonectes ? sp.	Low Jurassic-Cretaceous	Bivalves
C 323	22	Pucara Group	Psiloceras (Franziceras) sp.	Lower Jurassic-Hettangian	Ammonite
			Psiloceras (P) ? sp.	Lower Jurassic-Hettangian	Ammonite
			Psiloceratinar Gen. et.sp. indet	Lower Jurassic-Hettangian	Ammonite
I 347	B17	Pucara Group	Arietitidae, Gen.et sp.	Lower Jurassic, Sinemurian-Lower Pliensbachian	Ammonite
L 301	21	Pucara Group	Gastropods	Jurassic	Gastropods
			Bivalves	Jurassic	Bivalves
			Echinoids	Jurassic	Echinoids
L 319	21	Pucara Group	Crinoids stem	Jurassic	Crinoids stem
L 337	6	Pucara Group	Pentacrinites sp.	Jurassic	Crinoids stem
L 338	6	Pucara Group	Echinoids spine	Jurassic	Crinoids spine
			Mollusc shells	Jurassic	Mollusc shells
			Crinoids stem	Jurassic	Crinoids stem
M 451	E12	Pucara Group	Euasteroceras sp.	Lower Jurassic-Sinemurian	Ammonite
			Epammonites sp.	Lower Jurassic-Sinemurian	Ammonite
			Gleviceras ? sp.	Lower Jurassic-Sinemurian	Ammonite
			Cheltonia ? sp.	Lower Jurassic-Sinemurian	Ammonite
			Oxytoma sp.	Upper Jurassic-Lower Cretaceous	Bivalves
P 445	Nc	Pucara Group	Arietitidae Gen. et sp.	Lower Jurassic. Sinemurian-Low Pliensbachian	Ammonite
P 503	4	Pucara Group	Entolium (Entolium) sp.	Middle Triassic-Upper Cretaceous	Bivalves
			Weyla (weyla) sp. (Pectinidae)	Upper Triassic-Middle Jurassic	Bivalves
S 327	21	Pucara Group	Echinoids spine	Jurassic	Echinoids spine
A 352	C14	Pucara Group	Not Identified.		
L 315	21	Pucara Group			
L 456	10	Pucara Group			

A. I · 9. Photographs of fossils

Explanation of Plate 1

Figs. 1a, b. Arietitidae gen. et sp. indet.
Two side views of a poorly preserved specimen, I 347, ×0.9.

Fig. 2. Euasteroceras sp.
Right side view of a large fragmental specimen, M 451, ×0.9.

Figs. 3-5. Epammonites sp.

Fig. 3. Left side view of a small specimen, M 451, ×1.5.

Fig. 4. Left side view of a small fragmental specimen, O 322, ×1.5.

Fig. 5. Left side view of a rather well preserved specimen, M 451, ×0.9.

Figs. 6-8. Euasteroceras sp.

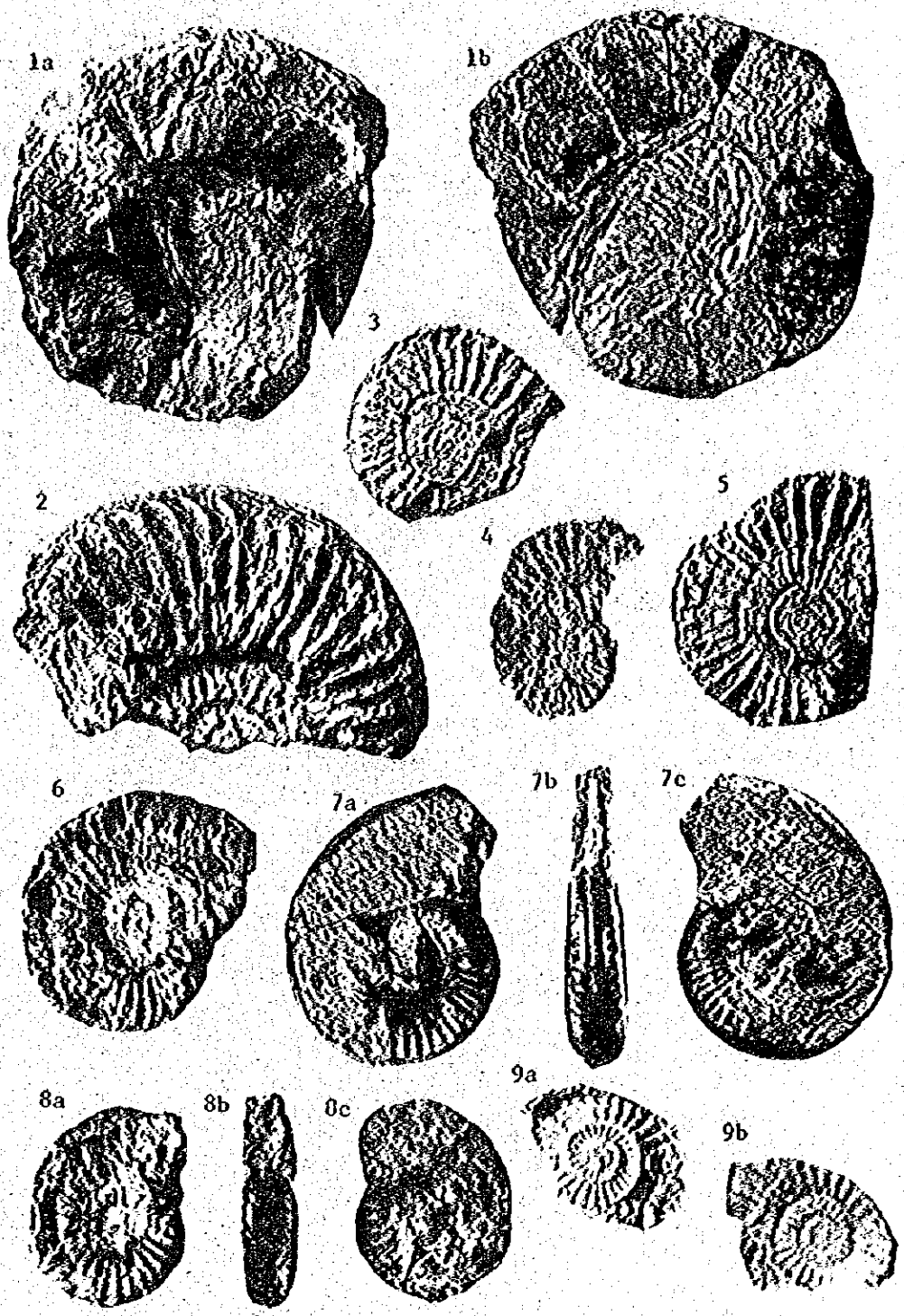
Fig. 6. Left side view of a small compressed specimen, M 451, ×1.5.

Figs. 7a-c. Left, apertural and right side views of a small rather well preserved specimen, M 451, ×1.5.

Figs. 8a-c. Left, apertural and right side views of a small rather compressed specimen, M 451, ×1.5.

Figs. 9a, b. Arietitidae gen. et sp. indet.
External mold and gum model of a small fragmental specimen, P 445, ×2.5.

Plate 1



Explanation of Plate 2

Figs. 1a-c. Psiloceras (Franziceras) sp.
Left, ventral and right side views of a rather well preserved specimen, C 323, ×0.9.

Figs. 2, 3. Psiloceras (Franziceras) ? sp.
External mold and gum model of two small fragmental specimens, C 323, ×1.5.

Fig. 4 Gleviceras ? sp.
Left side view of a poorly preserved specimen, M 451, ×0.9.

Fig. 5. Cheltonia ? sp.
Right side view of a small deformed specimen, M 451, ×2.5.

Figs. 6a, b. Cheltonia ? sp.
External mold and gum model of a very small ill-preserved specimen, M 451, ×2.

Figs. 7a-c. Psiloceratinae gen. et sp. indet.
Right, ventral and left side views of a fragmental specimen, C 323, ×1.

Fig. 8. Camptonectes ? sp.
Left valve of a very small ill-preserved specimen, C 322, ×8.

Figs. 8, 9. Entolium (Entolium sp.)
Left valve of two fragmental specimens, P 503, ×1.5.

Fig. 11. oxytoma (oxytoma) sp.
Left valve of a fragmental specimen, M 451, × 1.4.

Figs. 12-17. Weyla (weyla) sp.

Figs. 12a-c. Steinkern, external mold and gum model of a fragment of right valve, P 503 × 1.2.
Fig. 13. Steinkern of a fragment of right valve, posterior auricle preserved, P 503, × 1.4.
Figs. 14. External mold and gum model of a fragment of right valve, posterior auricle preserved, P 503, × 1.3.
Fig. 15. Steinkern of a fragment of right valve, P 503, × 1.3.
Figs. 16a, b. External mold and gum model of left valve of the same specimen as Fig. 15, P 503, × 1.3.
Figs. 17a, b. External mold and gum model of a fragment of left valve, P 503, × 1.3.

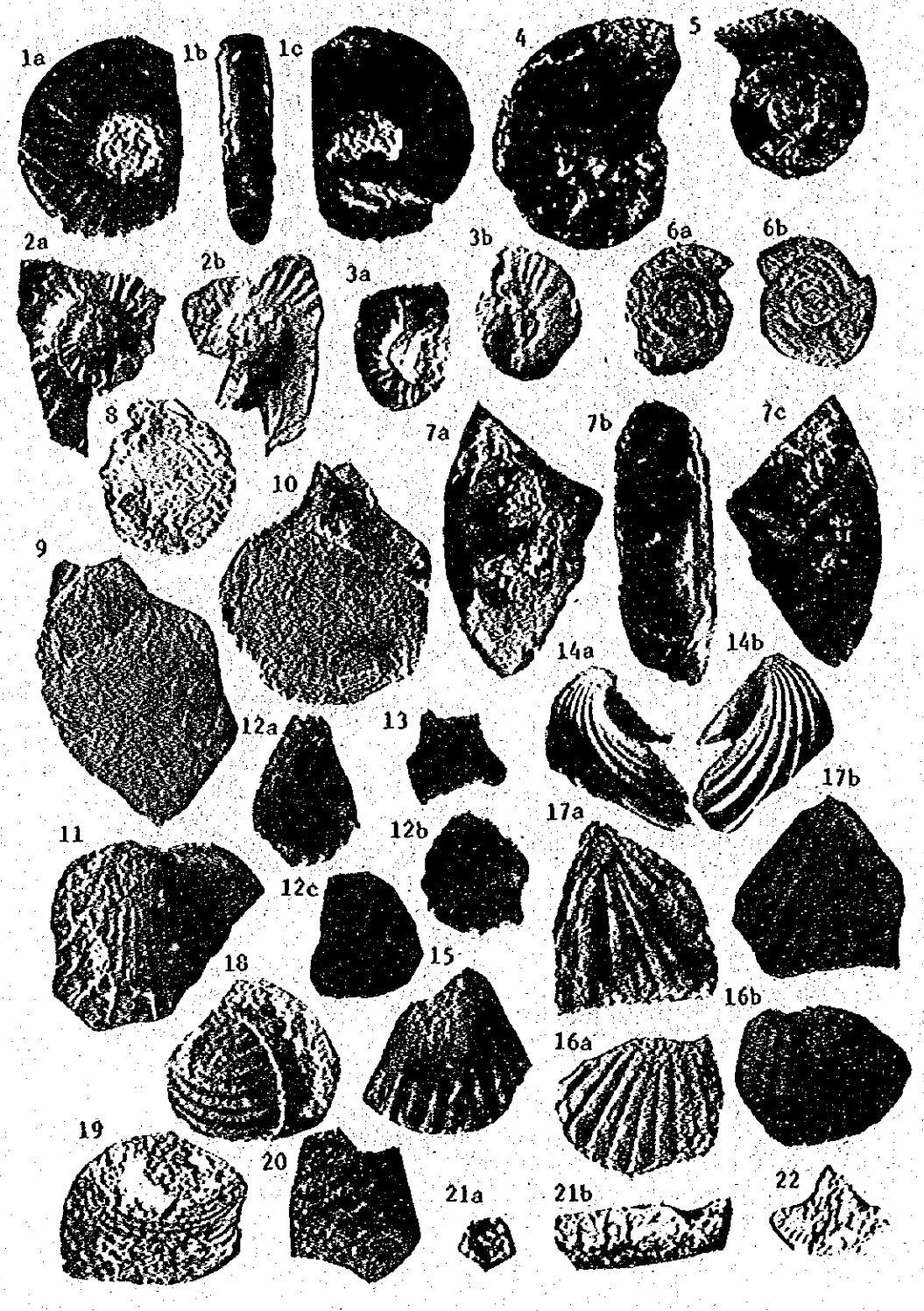
Figs. 18-20. Astarte sp.

Fig. 18. Right valve of a very small specimen, A 376, × 6.
Fig. 19. Left valve of a poorly preserved specimen, A 376, × 2.
Fig. 20. Left valve of ill-preserved small specimen, A 376, × 5.

Figs. 21a, b. Crinoid stem gen. et sp. indet.
Axial and side views of a crinoid stem, A 376, × 6.

Fig. 22. "Pentacrinites" sp.
Axial view of a fragmental stem, L 337, × 6.

Plate 2


1a
1b
1c
4
5
2a
2b
3a
3b
6a
6b
8
7a
7b
7c
10
9
14a
14b
12a
13
17b
17a
11
12b
12c
18
15
16b
16a
19
20
21a
21b
22

Explanation of Plate 3

Figs. 1, 2. Bio-micrite with gastropods shell. A 323.
Many small gastropods and few echinoid fragments are cemented by micritic calcite, ×10. Gastropods and echimoids can not be identified.

Fig. 3. Bio-micrite. A 340.
Muddy micritic limestone with echinoid spine, molluscan shell and intraclasts, deformed rather distinctly by plastic flow, ×10.

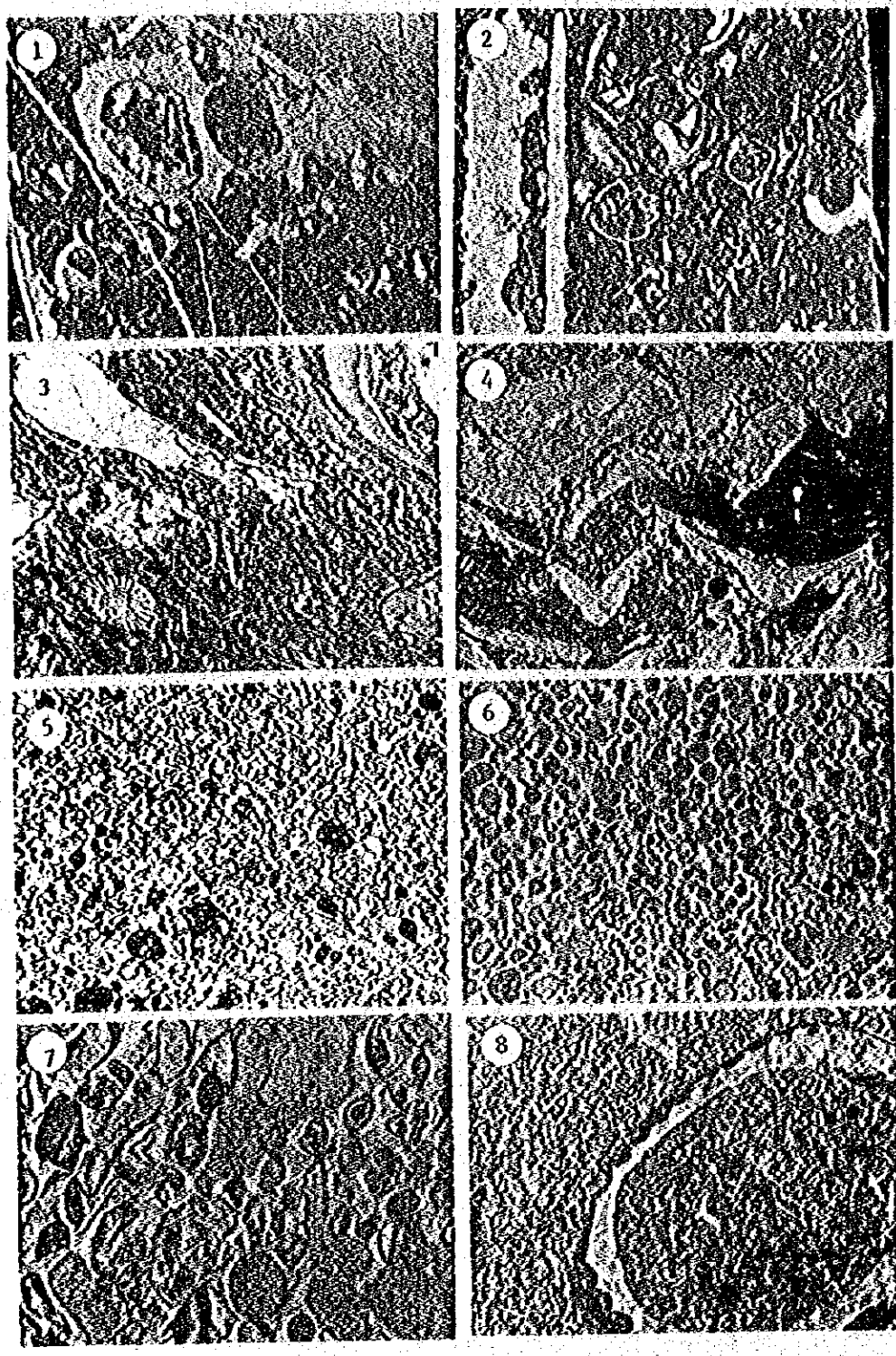
Fig. 4. Calcareous shale with molluscan shells. A 345.
Molluscus can not be identified. ×10.

Fig. 5. Calcareous shale with carbonaceous matter. A 352. ×10.

Fig. 6. Slightly dolomitized pelsparite. A 359. ×10.
Fine grained pellets and few fragments of shell are cemented by fine sparry calcite.

Fig. 7. Fossiliferous oosparite. A 363. ×10.
Coarse grained intraclasts, echinoid fragments and oolites are cemented by sparry calcite.

Fig. 8. Fossiliferous micrite. A 376. ×10.
Sponge spicules and shell fragments are cemented by micritic fine calcite. Sponge and shell can not be identified.


1
2
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7
8

Explanation of Plate 4

Fig. 1. Possiliferous sandy limestone. L 301. ×10
Small fragments of echinoids, gastropods and bivalves, and very fine grained angular quartz and feldspar are cemented by micritic limestone. Fossils can not be identified.

Fig. 2. Distinctly brecciated and silicified oolitic limestone.
L 315. ×10

Fig. 3. Crinoidal sandy limestone. L 319. ×10
Fragments of crinoid stem, intraclastic limestone and several per cent of quartz and rock fragments are cemented by muddy micritic calcite.

Fig. 4. Crinoidal sandy limestone. L 337. ×10
Small fragments of crinoid stem, intraclastic limestone and nearly ten per cent of quartz and rock fragments are cemented by muddy micrite.

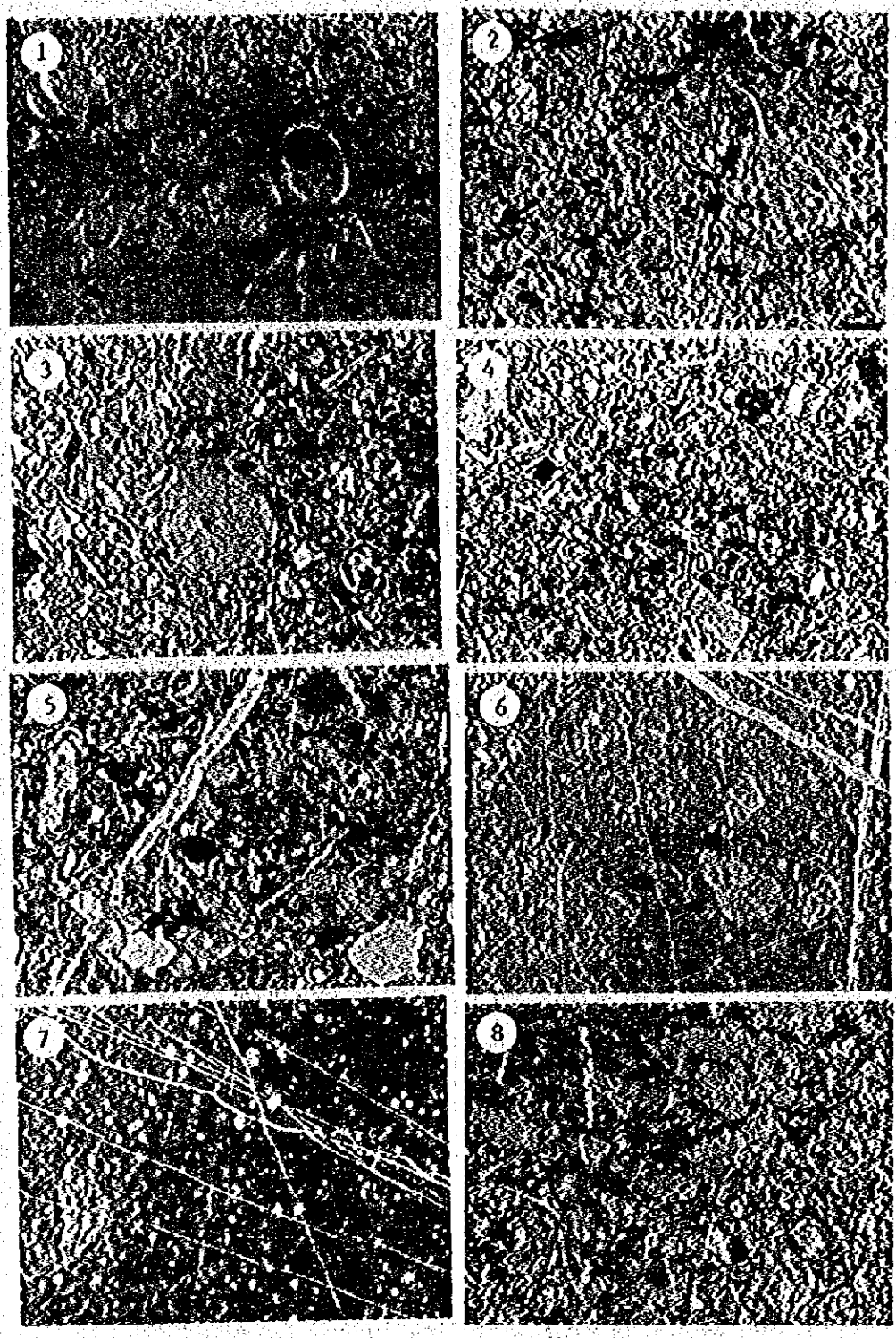
Fig. 5. Muddy bio-micrite. L 338. ×10
Small fragments of echinoid spine, molluscan shell and crinoidal stem are cemented by muddy micrite.

Figs. 6, 7. Radiolarian bio-micrite. C 323. ×10

Fig. 6. Very small gastropods and re-crystallized radiolarian remains are cemented by micrite.

Fig. 7. Showing re-crystallized radiolarian remains.

Fig. 8. Muddy limestone with echinoid spine. S 327. ×10
Many fragments of echinoid spine are cemented by muddy micrite.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A. I · 10. Results of X-ray diffraction test

◎ Very abundant

○ Abundant

○ Common

o Rare

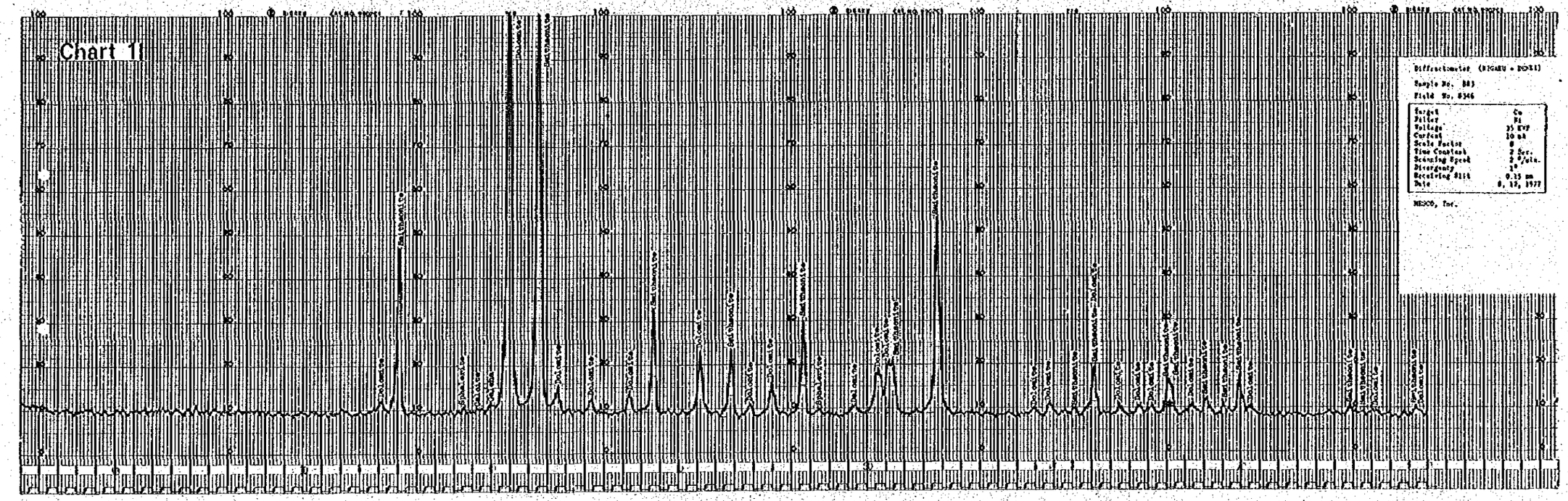
● Very rare

Sample No.	Field No. / Minerals	Dolomite	Calcite	Quartz	Biotite	Muscovite	Sericite	Olivine	Plagioclase	Microcline	Sphalerite	Smithsonite	Galena	Cerussite	Goethite	
687	A302		◎	●												
690	A309	◎	○													
693	A320	○	◎	○												
698	A327	◎	○													
709	C301	◎		◎												
710	C306	◎		○												
711	C307	◎	○	○												
721	C347	◎	○	○												
723	C361		◎	◎					○							
725	C404	◎	○	●												
734	C523	◎	○	○												
735	C526	◎	◎	○												
739	I304	●	◎	○												
742	I310		◎	○												
745	I320	◎	○	○												
752	I357	○	○	○												
758	L314		◎	○												
760	L317	◎	○	○												
761	L318	◎	○	○												
764	L321	○	◎	○												
765	L322	◎	○	○												
775	L364	◎						●								
782	L390	◎	○	●												
783	L392	◎	○													

Sample No.	Field No. / Minerals	Dolomite	Calcite	Quartz	Biotite	Muscovite	Sericite	Olivine	Plagioclase	Microcline	Sphalerite	Smithsonite	Galena	Cerussite	Goethite	
787	L418	◎	●	○												
789	L434	◎	●	○												
790	L436	◎	●	●												
804	L622	◎	○	○												
810	M314		◎	○												
814	M343	◎	○	○												
815	M372	●	◎	○												
828	M459	◎	○													
863	P588		◎									●				
869	S310	◎	◎													
870	S311		◎	○												
871	S312		◎	○							●					
883	S346	◎	●								●	◎	●			
886	S349	◎	●	●												
888	S351	◎							●		○	○	○			
889	S352	◎														

Sample No.	Field No. \ Minerals	Dolomite	Calcite	Quartz	Biotite	Muscovite	Sericite	Olivine	Plagioclase	Microcline	Sphalerite	Smithsonite	Galena	Cerussite	Goethite
	R303	◎	o						●						
	R305			◎			o			o					
	R309		◎	◎											
	R312		◎	◎		●									
	R314	●	◎	○											
	R318	○	◎	○											
	R328	◎		●											
	R334	◎	○	●											
	R339			◎			o			o					
	R340	o	o												○
	R345	◎									◎	●	o	●	
	R347		◎		○				◎						

A. I - 11. Charts of X-ray diffraction test



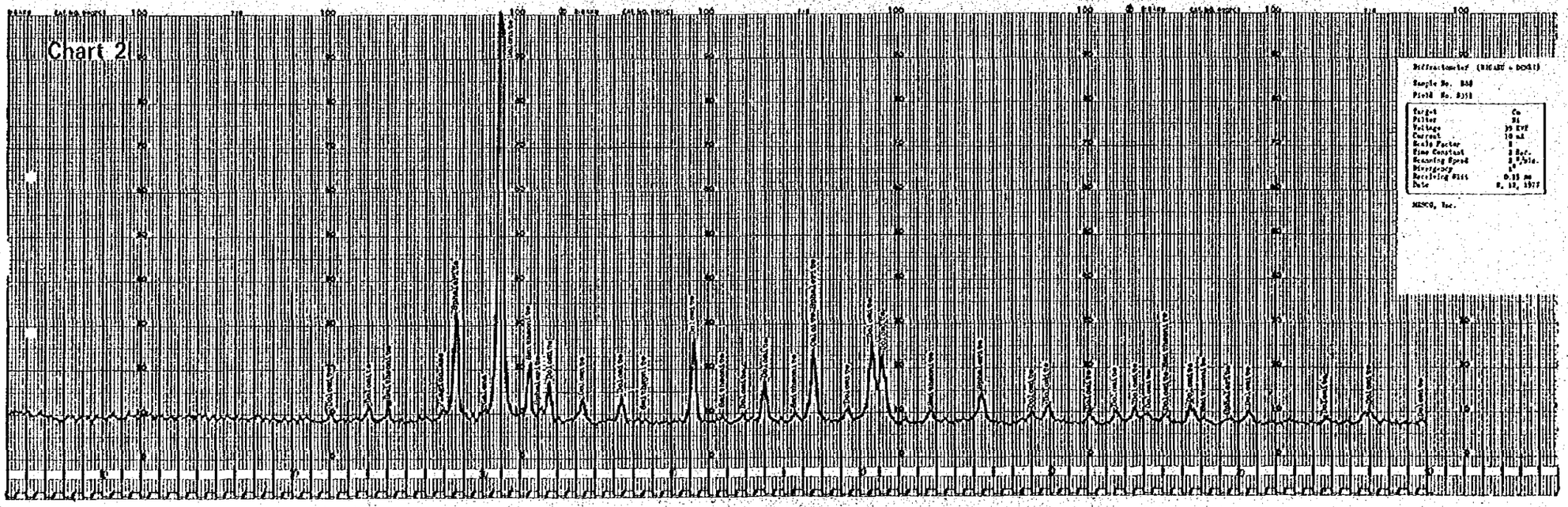


Chart 3

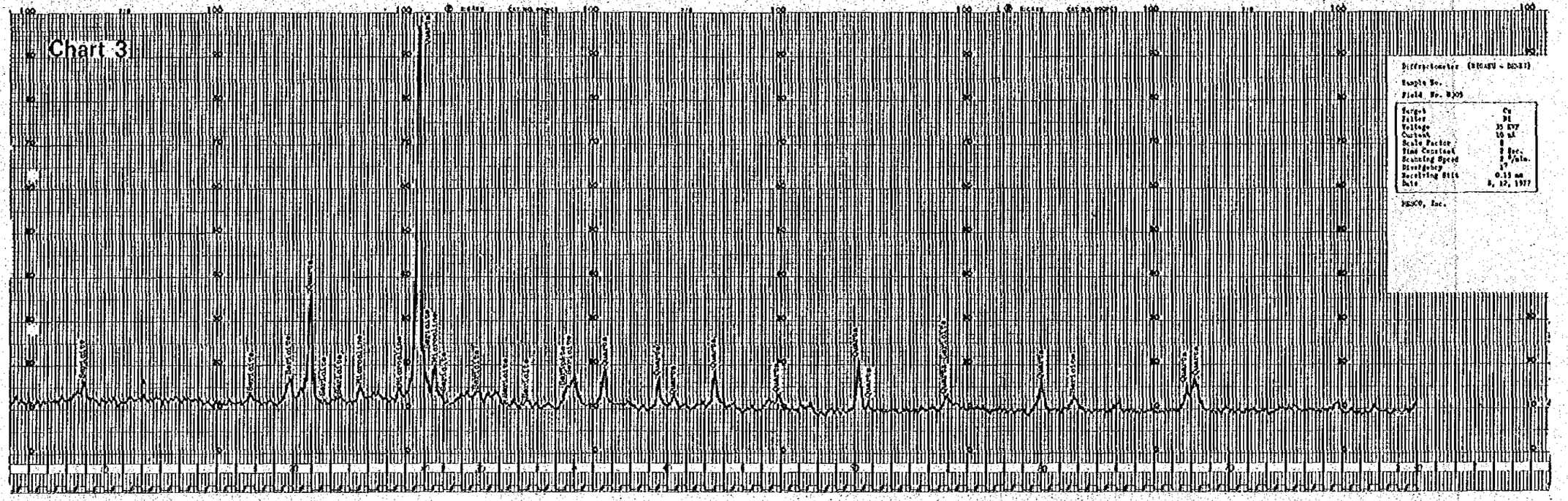
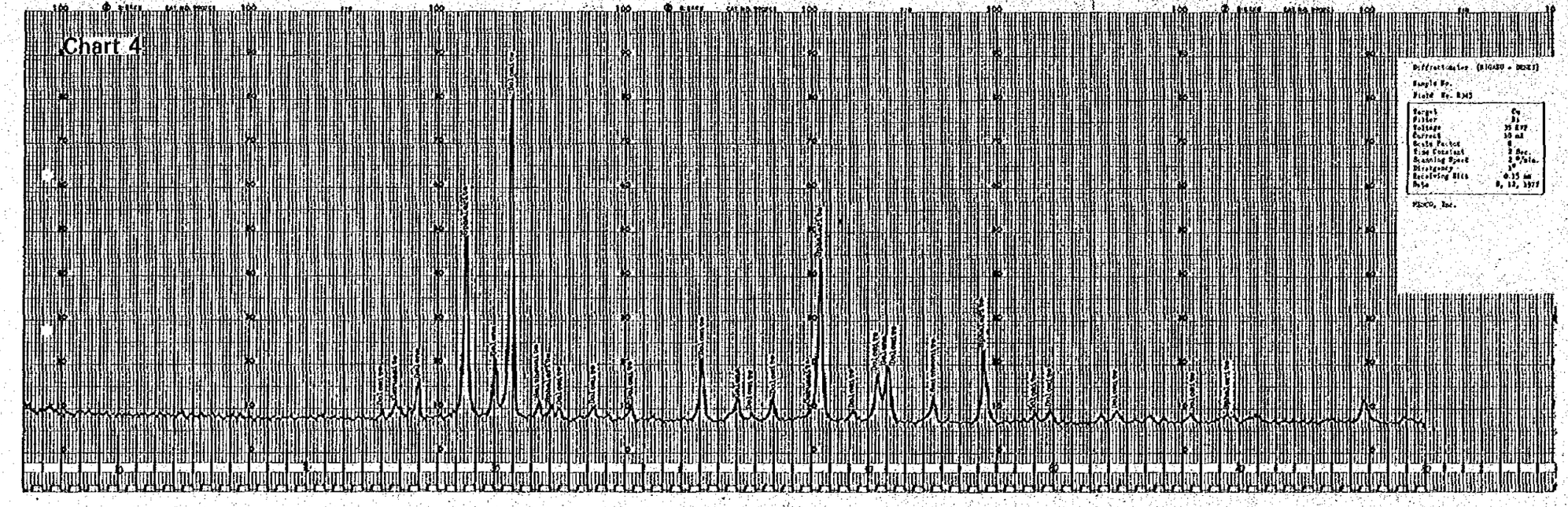


Chart 4



A. I - 12. Flow sheets of chemical analysis

(Cu, Pb, Zn, Ni, Mg)

Sample (1 g) (in 100 - 300 ml conical beaker).

|← $HCl + HNO_3 + H_2O$ (3:1:1, 20 ml).

|← $HClO_4$ (5 ml).

Evaporation for consolidation.

|← (1:1) HCl (8 ml).

Heating for solution.

|

Cooling (at room temperature).

|

Transfering in 100 ml beaker.

|

Shaking.

|

Filtration (No. 6, 9 cm).

|

Atomic absorption.

(S)

Sample (0.5 g) (in 100 ~ 300 ml conical beaker).

← $KClO_4$, about 1 g.

← HNO_3, 30 ml.

Leaveing out at room temperature.

(reacting to SO_4 for about 30 minutes).

Evaporation for consolidation.

(at lower than 100°C).

Cooling.

← HCl 5 ml.

← H_2O 30 ml.

Heating for solution.

Filtration (No. 131, 15 cm, filter paper).

Vashing (hot water added to filtrate makes 200 ml).

Heating (until reaching a boil).

(If Fe is present, it is added a few drops of $NH_2OH.HCl$ (10%) and becomes colourless).

← $BaCl_2$ (10%) 20 ml.

Heating and leaveing out (for 2 ~ 3 hours).

Filtration (No. 6, 12.5 cm)

Evaporation.

Laying in ashes (at 900 ~ 1,000°C).

Cooling (in desiccator).

Weighing. (S % is $\frac{S}{BaSO_4}$)

A. I - 13. (1) Geochemical contents of 3-elements in rocks of the detailed survey area

Geological Index

Sedimentary rocks		
Chonta Group		CH
Oriente Group		OR
Pucara Group		PDO --- Dolomite PLS --- Limestone PSS --- Sandstone
Igneous rocks		
Tertiary	Volcanics	TV
	Rhyolite & Dacite	TR
Cretaceous~Tertiary	Quartz porphyry & Granite porphyry	MP

Sample No	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
1	21	L301	PLS	5	53	766
2	21	L302	PLS	10	88	513
3	21	L303	PLS	9	371	604
4	21	L304	TV	0	457	462
5	21	L305	PDO	11	7,300	350
6	21	L306	PLS	3	790	1,868
7	21	L307	PLS	2	38	335
8	21	L308	PLS	28	414	442
9	21	L309	PLS	4	1,121	135
10	21	L310	PLS	2	121	107
11	21	L311	PLS	11	301	855
12	21	L312	PLS	8	446	690
13	21	L313	PLS	10	634	391
14	21	L314	PLS	3	68	393
15	21	L315	PLS	4	91	1,508
16	21	L316	PLS	40	348	1,480
17	21	L317	PDO	7	81	327
18	21	L318	PDO	6	48	89
19	21	L319	PLS	15	5,120	152
20	21	L320	PLS	13	813	216
21	21	L321	PLS	7	66	429
22	21	L322	PDO	23	43	45
23	21	L323	PLS	8	43	355
24	21	L324	PLS	6	414	690
25	21	L325	PLS	6	56	581
26	21	L326	PLS	4	63	302
27	21	L327	PLS	6	43	358
28	21	L328	PLS	25	457	1,048
29	21	L329	PLS	12	424	556
30	21	L330	PLS	4	33	612
31	21	L331	PLS	6	109	563
32	6	L332	TV	11	187	157
33	6	L333	PLS	7	773	383
34	6	L334	PDO	9	518	178
35	6	L335	PLS	7	149	850
36	6	L336	PLS	6	121	249
37	6	L337	PLS	6	192	269
38	6	L338	PLS	7	356	279
39	6	L339	PLS	6	197	302
40	6	L340	PLS	5	217	246
41	6	L341	TV	12	5	30
42	6	L342	PLS	71	23	330
43	6	L343	PLS	6	33	84

Sample No	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
44	6	L344	PLS	19	28	617
45	6	L345	PLS	8	247	1,094
46	6	L346	PLS	4	30	329
47	6	L347	PDO	3	40	109
48	6	L348	PLS	11	1,237	363
49	6	L349	PLS	7	414	398
50	6	L350	PLS	4	114	734
51	6	L351	PLS	29	1,452	180
52	6	L352	PLS	10	717	1,046
53	6	L353	PDO	1	45	1,787
54	6	L354	PLS	4	212	1,051
55	6	L355	PLS	9	220	1,071
56	6	L356	PLS	2	51	556
57	6	L357	PDO	1	119	1,315
58	6	L358	PLS	7	841	530
59	6	L359	PLS	11	172	272
60	6	L360	PLS	6	131	708
61	6	L361	PLS	6	68	703
62	6	L362	PDO	4	61	1,426
63	22	L363	PDO	4	35	21
64	22	L364	PDO	11	65	23
65	22	L365	PDO	3	38	10
66	22	L366	PDO	2	40	9
67	22	L367	PDO	5	38	10
68	22	L368	PDO	7	35	14
69	22	L369	PDO	6	40	11
70	22	L370	PDO	2	43	13
71	22	L371	PDO	8	43	17
72	22	L372	PDO	10	35	14
73	22	L373	PDO	7	35	24
74	22	L374	PDO	2	33	15
75	22	L375	PDO	2	48	162
76	22	L376	PDO	3	38	18
77	22	L377	PDO	3	33	24
78	22	L378	PDO	2	38	17
79	22	L379	PDO	37	28	35
80	22	L380	PDO	10	33	13
81	22	L381	PDO	4	40	22
82	22	L382	PDO	6	48	13
83	22	L383	PDO	3	40	14
84	22	L384	PDO	4	68	16
85	22	L385	PDO	5	40	36
86	22	L386	PLS	3	35	88

Sample No	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
87	22	L357	PDO	4	38	15
88	22	L358	PDO	3	33	9
89	22	L359	PDO	4	38	14
90	22	L390	PDO	5	45	16
91	22	L391	PLS	10	33	16
92	22	L392	PLS	3	35	13
93	22	L393	PDO	5	40	22
94	22	L394	PDO	4	43	13
95	22	L395	PLS	6	56	105
96	22	L396	PLS	4	38	33
97	22	L397	PLS	4	38	23
98	22	L398	PLS	6	30	17
99	22	L399	PLS	2	38	24
100	22	L400	PDO	3	40	36
101	22	L401	PDO	4	43	18
102	22	L402	PDO	6	43	27
103	22	L403	PDO	4	45	22
104	22	L404	PDO	3	40	18
105	22	L405	PDO	5	40	9
106	22	L406	PDO	5	40	13
107	22	L407	PLS	5	45	22
108	11	L408	PLS	4	40	11
109	11	L409	PLS	3	45	14
110	11	L410	PDO	2	38	12
111	11	L411	PDO	3	30	10
112	11	L412	PDO	4	33	12
113	11	L413	PDO	3	33	14
114	11	L414	PDO	2	33	10
115	11	L415	PDO	3	38	11
116	11	L416	PDO	5	28	10
117	11	L417	PDO	6	33	15
118	11	L418	PLS	6	30	12
119	11	L419	PLS	5	35	10
120	11	L420	PLS	3	35	13
121	11	L421	PDO	7	30	10
122	11	L422	PDO	7	35	16
123	11	L423	PDO	5	35	10
124	11	L424	PDO	11	45	17
125	11	L425	PDO	2	38	9
126	11	L426	PDO	2	38	12
127	11	L427	PDO	8	38	14
128	11	L428	PDO	6	38	15
129	11	L429	PDO	7	68	62

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
130	11	L430	PDO	6	45	17
131	11	L431	PDO	4	28	13
132	11	L432	PLS	7	26	27
133	22	L433	PDO	4	31	10
134	22	L434	PDO	4	28	11
135	22	L435	PDO	5	28	14
136	22	L436	PDO	3	28	16
137	22	L437	PDO	2	34	14
138	22	L438	PLS	6	28	27
139	22	L439	PLS	5	26	32
140	22	L440	PLS	6	31	17
141	10	L450	PDO	2	41	150
142	10	L451	PLS	6	34	52
143	10	L452	PLS	6	88	648
144	10	L453	PSS	11	39	17
145	10	L454	PSS	49	8	24
146	10	L455	PLS	15	65	130
147	10	L456	PLS	5	28	19
148	10	L459	PLS	8	26	59
149	10	L460	PLS	4	54	245
150	10	L461	PDO	4	67	500
151	10	L462	PDO	2	34	82
152	10	L463	PDO	4	31	142
153	10	L464	PLS	5	60	476
154	10	L465	PLS	4	28	62
155	10	L466	PDO	4	41	189
156	10	L467	PLS	4	31	58
157	10	L468	PLS	4	28	27
158	10	L469	PLS	4	31	36
159	10	L470	PLS	4	31	118
160	10	L471	PLS	3	31	46
161	10	L472	PLS	7	31	35
162	10	L473	PLS	3	52	70
163	10	L474	PLS	4	34	32
164	10	L475	PLS	3	41	54
165	10	L476	PLS	4	26	80
166	10	L477	PSS	5	0	52
167	10	L482	PLS	3	39	40
168	10	L483	PLS	3	44	100
169	10	L484	PLS	5	44	49
170	10	L490	PLS	6	80	148
171	10	L491	PLS	3	187	375
172	10	L492	PLS	5	52	296

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
173	10	L493	PLS	35	78	204
174	10	L494	PDO	3	61	90
175	10	L495	PDO	4	57	201
176	10	L496	PLS	4	34	56
177	22	L498	PDO	6	41	21
178	22	L499	PDO	4	36	16
179	22	L500	PDO	3	39	8
180	22	L501	PDO	4	41	13
181	22	L502	PDO	4	43	19
182	22	L503	PDO	22	39	20
183	22	L504	PDO	3	44	23
184	22	L505	PDO	3	44	19
185	22	L506	PDO	3	44	21
186	22	L507	PDO	14	49	97
187	22	L508	PDO	4	47	20
188	22	L509	PDO	7	44	25
189	22	L510	PDO	9	44	15
190	9	L520	PDO	11	47	21
191	9	L521	PDO	6	31	16
192	9	L522	PDO	7	34	20
193	9	L523	PDO	6	34	16
194	9	L524	PDO	6	36	14
195	9	L525	PLS	8	34	14
196	9	L526	PLS	9	36	17
197	22	L601	PDO	20	36	19
198	22	L602	PLS	5	41	31
199	22	L603	PLS	4	26	34
200	22	L604	PLS	5	36	13
201	23	L605	PLS	6	30	226
202	23	L606	PDO	3	27	151
203	23	L607	PLS	6	21	59
204	23	L608	PDO	4	23	40
205	23	L609	PDO	44	32	56
206	22	L612	PLS	6	27	26
207	22	L613	PLS	5	25	23
208	22	L614	PDO	4	68	78
209	22	L615	PDO	3	36	17
210	22	L616	PDO	3	25	42
211	22	L617	PDO	3	59	74
212	22	L618	PDO	5	57	35
213	22	L619	PDO	4	25	16
214	22	L620	PDO	6	21	27
215	23	L621	PDO	7	23	20

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
216	23	L622	PDO	5	32	49
217	23	L623	PDO	4	57	70
218	23	L624	PDO	7	30	56
219	23	L625	PDO	5	34	57
220	23	L626	PDO	6	32	72
221	23	L627	PDO	7	63	78
222	23	L628	PDO	3	34	22
223	23	L629	PDO	6	32	17
224	23	L630	CH	9	32	28
225	23	L631	PLS	7	32	40
226	23	L632	PLS	7	31	35
227	23	L633	PDO	9	44	30
228	23	L634	PDO	19	35	29
229	23	L635	PDO	5	34	17
230	23	L636	PDO	5	48	27
231	23	L637	PDO	8	27	29
232	23	L638	PDO	5	40	35
233	4	C301	PLS	36	65	221
234	4	C302	PLS	13	41	47
235	4	C303	MP	18	4	83
236	4	C304	TV	6	6	91
237	4	C305	TR	16	120	252
238	4	C306	PLS	18	82	149
239	4	C307	PLS	10	32	70
240	4	C308	PLS	7	348	4,220
241	4	C309	PLS	12	103	736
242	4	C310	PLS	28	137	666
243	7	C311	PLS	11	30	55
244	7	C312	PLS	10	34	78
245	7	C313	PLS	11	55	229
246	7	C314	PLS	13	40	153
247	7	C315	PDO	13	34	97
248	7	C316	PDO	7	46	142
249	7	C317	PLS	12	42	50
250	7	C318	PLS	9	40	47
251	7	C319	PLS	11	53	279
252	7	C320	PLS	40	36	78
253	7	C321	PDO	4	35	42
254	10	C328	PLS	7	55	82
255	11	C329	PLS	5	40	41
256	11	C330	PLS	7	42	94
257	11	C331	PLS	21	46	40
258	11	C332	PLS	6	40	24

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
259	11	C333	PSS	4	203	162
260	11	C334	PLS	10	68	159
261	11	C335	PLS	5	32	152
262	11	C336	PLS	8	51	75
263	10	C337	PLS	9	32	96
264	10	C338	PLS	6	34	53
265	10	C339	PLS	7	34	26
266	11	C340	PLS	74	46	197
267	11	C341	PLS	18	38	76
268	11	C342	PLS	12	49	263
269	11	C343	PLS	10	51	38
270	11	C344	PLS	10	46	54
271	11	C345	PLS	10	25	69
272	11	C346	PLS	4	78	60
273	11	C347	PSS	28	34	33
274	11	C348	PDO	10	63	40
275	11	C349	PLS	6	25	25
276	11	C350	PLS	7	38	24
277	11	C351	PLS	7	32	43
278	11	C352	PLS	5	44	49
279	11	C353	PDO	24	32	33
280	11	C354	PDO	9	36	39
281	11	C355	PLS	22	70	385
282	11	C356	PLS	9	42	63
283	11	C357	PDO	11	49	48
284	11	C358	PDO	13	40	91
285	11	C359	PSS	3	36	32
286	11	C360	PLS	10	36	44
287	11	C361	PSS	44	32	145
288	11	C362	PSS	16	32	67
289	22	C381	PDO	4	46	28
290	22	C382	PDO	4	40	16
291	22	C383	PDO	36	30	21
292	22	C384	PDO	4	52	34
293	22	C385	PDO	6	30	28
294	22	C386	PDO	8	51	17
295	22	C387	PDO	4	32	13
296	22	C388	PDO	2	34	17
297	22	C389	PDO	4	32	20
298	22	C390	PDO	10	38	37
299	9	C391	PLS	8	38	32
300	9	C392	PDO	17	59	35
301	9	C393	PDO	4	33	18

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
302	9	C394	PDO	3	35	11
303	9	C395	PDO	3	35	16
304	9	C396	PDO	4	35	15
305	9	C397	PLS	5	37	17
306	9	C398	PDO	3	35	15
307	9	C399	PDO	3	35	13
308	9	C400	PDO	11	37	16
309	9	C401	PLS	103	26	28
310	9	C402	PDO	2	39	26
311	9	C403	PLS	6	13	163
312	4	C404	PLS	12	318	406
313	4	C405	MP	15	13	31
314	4	C406	MP	102	9	32
315	4	C407	MP	30	9	27
316	4	C408	PLS	14	57	223
317	4	C409	PLS	9	9	65
318	4	C410	PLS	17	4,715	232
319	23	C501	PLS	73	44	35
320	23	C502	PLS	3	42	18
321	23	C503	PLS	4	24	21
322	23	C504	PLS	2	20	19
323	23	C505	PLS	6	29	42
324	23	C506	PLS	11	33	44
325	23	C507	PLS	7	26	24
326	23	C508	PLS	4	33	196
327	23	C509	PLS	72	24	33
328	23	C510	PLS	5	22	25
329	23	C511	PLS	4	26	30
330	23	C512	PLS	7	18	35
331	23	C513	PLS	12	24	20
332	23	C514	PLS	3	24	18
333	23	C515	PDO	2	29	31
334	23	C516	PLS	16	29	46
335	23	C517	CH	17	22	31
336	23	C518	CH	20	18	33
337	23	C519	CH	80	29	38
338	23	C520	CH	8	22	17
339	23	C521	OR	11	0	9
340	23	C522	PDO	2	22	22
341	23	C523	PDO	6	15	23
342	23	C524	PLS	7	24	13
343	23	C525	PLS	3	22	33
344	23	C526	PLS	7	20	22

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
345	23	C527	PLS	3	24	24
346	23	C528	PLS	4	20	23
347	23	C529	FSS	22	20	106
348	23	C530	PLS	3	31	46
349	23	C531	PLS	5	11	14
350	23	C532	FSS	6	24	29
351	23	C533	PLS	7	26	14
352	23	C534	PDO	10	26	20
353	23	C535	PDO	4	37	33
354	23	C536	PDO	15	22	27
355	23	C537	PDO	3	31	12
356	23	C538	PDO	6	24	9
357	23	C539	PDO	5	29	14
358	23	C540	PDO	9	35	13
359	23	C541	PDO	9	24	13
360	8	A301	PLS	5	35	95
361	8	A302	PLS	11	110	276
362	8	A303	PLS	8	64	98
363	8	A304	PDO	22	50	416
364	8	A305	PDO	5	30	1,566
365	8	A306	PDO	5	171	1,022
366	8	A307	PLS	10	1,031	312
367	8	A308	PDO	6	305	3,993
368	8	A309	PDO	4	107	3,975
369	8	A310	PDO	6	96	1,046
370	8	A311	PDO	5	497	1,298
371	10	A315	PLS	4	29	45
372	10	A317	PLS	7	29	34
373	10	A319	PLS	7	39	232
374	10	A320	PDO	15	64	367
375	10	A321	PLS	4	31	287
376	6	A323	PDO	4	26	21
377	6	A324	PDO	6	37	58
378	6	A325	PDO	6	15	65
379	6	A326	PDO	7	368	351
380	6	A327	PDO	17	591	833
381	6	A328	PDO	14	1,064	103
382	6	A329	PDO	17	297	823
383	6	A330	PDO	8	345	193
384	20	A331	PDO	7	39	73
385	20	A332	PDO	9	37	72
386	20	A334	PDO	11	545	704
387	20	A336	PLS	516	63	291

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
388	20	A337	PDO	85	33	43
389	20	A340	PLS	14	26	43
390	23	A401	CH	10	11	20
391	23	A402	CH	17	24	20
392	23	A403	PLS	59	31	62
393	23	A404	PLS	11	24	33
394	23	A405	PLS	8	29	29
395	23	A406	PLS	6	31	33
396	23	A407	CH	7	24	23
397	23	A408	CH	34	13	17
398	23	A409	PLS	5	24	71
399	23	A410	PLS	78	42	54
400	23	A412	PLS	8	4	258
401	23	A413	PLS	7	26	20
402	23	A414	PLS	4	26	67
403	23	A415	PLS	7	23	164
404	23	A416	PLS	7	24	44
405	23	A417	PLS	9	26	51
406	23	A418	PLS	8	15	47
407	23	A419	PLS	10	22	31
408	23	A420	PLS	45	26	46
409	23	A421	PLS	7	29	49
410	23	A422	CH	63	31	76
411	23	A423	PLS	5	20	20
412	23	A424	PLS	9	24	73
413	23	A425	PDO	5	31	95
414	23	A426	PDO	9	83	83
415	23	A427	PLS	6	37	19
416	23	A428	PLS	6	37	14
417	23	A429	PLS	7	26	38
418	23	A430	PLS	8	24	80
419	23	A431	PDO	4	24	28
420	6	1301	PLS	9	15	34
421	6	1302	PLS	6	24	56
422	6	1303	PLS	7	29	78
423	6	1304	PLS	9	63	340
424	7	1305	PLS	6	31	53
425	7	1306	PDO	5	26	69
426	7	1307	PLS	7	31	72
427	7	1308	PLS	6	26	101
428	7	1309	PLS	8	24	30
429	7	1310	PLS	7	22	52
430	6	1311	PLS	4	26	231

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
431	7	1312	MP	10	11	15
432	7	1313	PLS	5	33	29
433	6	1315	PLS	7	89	65
434	11	1316	PDO	30	59	13
435	11	1317	PDO	2	13	10
436	11	1318	PDO	3	18	10
437	11	1319	PDO	4	18	18
438	11	1320	PDO	11	20	12
439	12	1321	PLS	6	24	17
440	11	1322	PDO	3	26	13
441	11	1323	PDO	3	29	6
442	11	1324	PDO	3	29	9
443	11	1325	PDO	5	29	19
444	11	1326	PLS	4	24	10
445	10	1327	PLS	4	33	14
446	11	1328	PLS	10	24	100
447	11	1329	PLS	5	29	14
448	11	1330	PDO	4	37	9
449	11	1331	PLS	27	31	48
450	11	1332	PLS	6	29	17
451	11	1333	PDO	5	35	15
452	11	1334	PLS	20	33	13
453	11	1335	PDO	7	35	13
454	11	1336	PLS	9	26	48
455	B16	1338	PLS	8	31	26
456	TO	1340	PDO	4	29	14
457	F5	1350	PDO	3	64	43
458	9	1351	PDO	5	31	69
459	9	1352	PDO	11	31	16
460	9	1353	PDO	27	29	27
461	9	1354	PLS	6	48	35
462	9	1355	PLS	20	18	27
463	9	1356	PLS	4	26	15
464	7	1357	PLS	22	1,298	2,991
465	21	S301	PDO	10	70	530
466	21	S302	PDO	10	230	910
467	21	S303	PLS	10	80	390
468	21	S304	PLS	10	70	190
469	21	S306	PLS	10	30	130
470	21	S307	TR	10	30	90
471	21	S308	PLS	10	60	200
472	21	S309	PLS	10	560	490
473	21	S310	PLS	10	380	10,000

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
474	21	S311	PLS	20	1,190	5,250
475	21	S312	PLS	20	1,360	2,650
476	21	S313	PLS	10	80	230
477	21	S314	PLS	10	40	3,800
478	21	S315	PLS	10	910	80
479	21	S317	PLS	10	60	140
480	21	S319	PLS	10	110	320
481	21	S320	PLS	10	4,120	50
482	21	S321	PLS	60	1,080	400
483	21	S323	PLS	10	40	30
484	21	S324	PLS	10	420	530
485	21	S325	PLS	10	350	250
486	21	S326	PLS	10	40	100
487	4	S328	PLS	10	30	20
488	4	S329	PLS	10	30	20
489	4	S330	PLS	10	50	50
490	4	S331	PLS	10	50	30
491	4	S332	PLS	10	40	40
492	6	S338	PLS	10	50	420
493	6	S339	PLS	10	70	230
494	6	S340	PLS	10	140	270
495	6	S341	PLS	10	100	220
496	6	S342	PLS	10	60	970
497	23	L641	PDO	12	29	17
498	8	S353	PLS	10	70	250
499	8	S354	PLS	10	160	1,510
500	8	S355	PSS	10	100	990
501	8	S357	PLS	10	160	870
502	8	S358	PDO	10	50	200
503	6	S375	PLS	10	380	240
504	6	S376	PSS	10	40	40
505	6	S377	PLS	10	110	110
506	6	S379	PLS	10	190	370
507	6	S380	PLS	10	70	180
508	6	S381	MP	40	30	30
509	4	S382	MP	10	50	160
510	8	P301	PLS	10	70	270
511	8	P302	PLS	10	60	80
512	8	P303	PLS	10	3,250	4,950
513	8	P304	PDO	10	540	1,250
514	8	P305	PDO	10	90	590
515	8	P306	PDO	10	130	870
516	8	P307	PDO	10	290	470

Sample No	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
517	8	P308	PDO	10	190	320
518	8	P309	PDO	20	100	300
519	8	P310	PLS	10	160	360
520	8	P311	PLS	10	110	520
521	8	P312	PLS	10	60	1,810
522	8	P313	PLS	10	120	560
523	8	P314	PLS	10	50	130
524	8	P315	PDO	10	90	180
525	8	P316	PLS	10	540	210
256	8	P317	PDO	10	60	460
527	8	P318	PDO	10	60	3,450
528	8	P319	PDO	10	40	210
529	10	P324	PLS	3,520	100	830
530	10	P325	PLS	10	30	60
531	7	P326	PDO	10	30	20
532	7	P327	PLS	10	40	20
533	7	P328	PLS	10	30	140
534	7	P329	PLS	10	30	120
535	7	P330	PLS	10	30	40
536	7	P331	PLS	10	30	100
537	7	P332	PLS	10	30	50
538	7	P333	PLS	10	30	90
539	7	P334	PLS	10	30	60
540	7	P335	PLS	10	30	130
541	7	P336	PLS	10	50	400
542	7	P337	PLS	10	110	420
543	7	P338	PLS	10	70	500
544	7	P339	PLS	10	60	1,060
545	22	P341	PDO	10	50	50
546	22	P342	PDO	10	40	20
547	22	P343	PDO	10	30	30
548	22	P344	PDO	10	40	10
549	22	P345	PDO	10	40	20
550	22	P346	PDO	10	40	20
551	22	P347	PDO	10	80	20
552	22	P348	PDO	10	50	60
553	22	P349	PDO	10	30	70
554	22	P350	PDO	10	40	20
555	22	P351	PDO	10	50	50
556	22	P352	PDO	10	50	20
557	22	P353	PDO	10	30	20
558	22	P354	PDO	10	40	40
559	22	P355	PDO	10	40	20

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
560	22	P356	PDO	10	40	40
561	22	P357	PDO	10	40	20
562	22	P358	PDO	10	30	20
563	22	P359	PDO	10	40	20
564	22	P360	PDO	10	40	20
565	22	P361	PDO	10	40	20
566	22	P362	PLS	10	50	30
567	22	P363	PLS	10	40	30
568	22	P364	PLS	10	40	40
569	22	P365	PLS	10	40	50
570	22	P366	PLS	10	30	70
571	22	P367	PLS	10	50	150
572	22	P368	PLS	10	40	150
573	22	P369	PLS	10	30	80
574	22	P370	PLS	10	40	80
575	22	P371	PLS	10	30	90
576	22	P372	PLS	10	50	140
577	22	P373	PLS	20	30	90
578	22	P374	PDO	10	40	20
579	22	P375	PDO	10	40	20
580	22	P376	PDO	10	40	10
581	22	P377	PDO	10	50	20
582	22	P378	PDO	10	30	10
583	22	P379	PDO	10	40	20
584	22	P380	PDO	10	30	10
585	22	P381	PDO	10	40	20
586	22	P382	PDO	10	60	20
587	22	P383	PDO	10	30	10
588	22	P384	PDO	10	30	20
589	22	P385	PDO	10	30	10
590	22	P386	PDO	10	50	10
591	22	P387	PDO	10	40	10
592	22	P388	PDO	10	40	10
593	22	P389	PDO	10	30	10
594	22	P390	PDO	10	40	30
595	22	P391	PDO	10	30	20
596	22	P392	PDO	10	30	10
597	22	P393	PLS	10	30	10
598	22	P394	PLS	10	30	40
599	22	P395	PDO	10	30	20
600	22	P396	PDO	10	30	10
601	22	P397	PLS	10	30	30
602	22	P398	PLS	30	30	20

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
603	22	P399	PLS	10	30	20
604	22	P400	PDO	10	40	20
605	22	P401	PDO	10	30	10
606	22	P402	PDO	10	30	10
607	22	P403	PDO	10	30	10
608	22	P404	PDO	10	30	20
609	22	P405	PDO	10	30	20
610	22	P406	PDO	10	30	40
611	22	P407	PDO	10	30	20
612	22	P408	PDO	10	40	20
613	22	P409	PDO	10	40	20
614	22	P410	PDO	10	30	20
615	22	P411	PDO	10	30	20
616	22	P412	PDO	10	30	10
617	22	P413	PDO	10	40	20
618	22	P414	PDO	10	30	20
619	22	P415	PDO	10	30	20
620	22	P416	PDO	10	40	20
621	22	P417	PLS	10	40	60
622	22	P418	PLS	10	30	20
623	22	P419	PLS	10	30	40
624	22	P420	PLS	10	30	60
625	22	P421	PLS	30	30	180
626	22	P422	PLS	20	40	140
627	22	P423	PLS	20	40	30
628	22	P424	PLS	10	40	50
629	22	P425	PDO	10	40	10
630	22	P426	PDO	10	40	20
631	20	P427	PLS	10	1,600	1,120
632	20	P428	PLS	10	170	290
633	20	P429	PLS	10	130	790
634	20	P430	PLS	10	90	250
635	20	P436	PLS	10	60	90
636	20	P437	PLS	10	150	170
637	20	P438	PLS	10	150	90
638	20	P439	PLS	10	120	70
639	20	P440	PLS	10	70	70
640	20	P441	PDO	10	30	30
641	20	P442	PLS	10	40	10
642	20	P451	PLS	10	50	10
643	20	P452	PLS	10	30	70
644	20	P453	PLS	10	40	30
645	20	P454	PLS	10	60	30

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
646	20	P460	PDO	10	40	10
647	20	P461	PDO	10	30	20
648	20	P462	PLS	10	30	60
649	20	P463	PLS	10	30	20
650	20	P464	PLS	10	40	40
651	20	P469	PLS	10	30	10
652	20	P470	PLS	10	30	20
653	4	P471	PLS	10	30	30
654	4	P472	PLS	10	40	30
655	4	P473	PLS	10	40	30
656	4	P474	PLS	10	40	20
657	4	P475	PLS	10	40	20
658	4	P476	PLS	10	30	20
659	4	P477	PLS	10	30	10
660	4	P478	PLS	10	30	10
661	5	P479	PLS	10	40	20
662	5	P480	PDO	10	50	20
663	5	P481	PDO	10	30	10
664	5	P482	PDO	10	40	10
665	5	P483	PDO	10	50	30
666	4	P484	PDO	10	50	20
667	4	P485	PDO	10	40	30
668	4	P486	PDO	10	40	20
669	4	P487	PDO	10	40	30
670	4	P488	PLS	10	30	20
671	4	P489	PLS	10	30	20
672	4	P490	PLS	10	50	130
673	4	P491	PLS	10	80	80
674	4	P492	PLS	10	120	210
675	4	P493	PLS	10	150	290
676	4	P494	PLS	10	50	70
677	4	P495	PLS	10	80	120
678	4	P496	PLS	10	40	50
679	4	P497	PLS	10	60	20
680	4	P498	PLS	10	30	30
681	4	P499	PLS	10	50	70
682	4	P500	PLS	10	30	270
683	4	P501	PLS	10	40	110
684	4	P502	PLS	10	40	20
685	4	P504	PLS	10	130	920
686	13	P505	PLS	10	40	20
687	13	P506	PLS	10	50	30
688	13	P507	PDO	10	50	20

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
689	13	P508	PDO	10	60	40
690	13	P509	PLS	10	50	30
691	13	P510	PLS	10	40	20
692	13	P511	PDO	10	30	30
693	13	P512	PDO	10	30	30
694	10	P513	PLS	10	70	400
695	10	P514	PDO	10	50	40
696	10	P515	PLS	10	60	690
697	10	P516	PDO	10	1,200	3,350
698	10	P517	PLS	10	100	250
699	10	P518	PLS	10	70	460
700	10	P519	PLS	10	40	1,050
701	7	P522	PLS	10	210	1,130
702	7	P523	PDO	10	60	220
703	7	P524	PLS	10	60	250
704	7	P525	PLS	10	30	30
705	7	P526	PLS	10	30	50
706	7	P527	PLS	10	40	100
707	7	P528	PLS	10	40	80
708	7	P529	PLS	10	520	410
709	7	P530	PLS	10	60	800
710	7	P531	PLS	10	40	140
711	7	P532	PDO	10	60	110
712	7	P533	PDO	10	60	290
713	7	P534	PDO	10	70	150
714	7	P535	PDO	10	90	370
715	7	P536	PDO	10	30	180
716	7	P537	PDO	10	50	280
717	7	P538	PDO	10	30	60
718	7	P539	PDO	10	40	190
719	8	P557	PLS	10	500	1,210
720	8	P560	PDO	10	100	390
721	8	P561	PDO	10	350	1,170
722	8	P562	PDO	10	40	110
723	8	P563	PDO	10	60	80
724	8	P564	PDO	10	40	210
725	15	P566	PLS	10	30	30
726	15	P567	PLS	10	30	20
727	15	P568	PLS	30	30	70
728	15	P569	PLS	10	30	120
729	15	P570	PLS	10	50	60
730	15	P571	PLS	10	30	40
731	15	P572	PLS	10	40	40

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
732	15	P573	PLS	10	40	110
733	15	P574	PLS	20	30	130
734	15	P575	PLS	10	30	110
735	15	P576	PLS	10	30	100
736	15	P577	PLS	10	80	120
737	8	P580	PLS	30	700	190
738	8	P581	PLS	10	100	130
739	8	P582	PLS	10	390	320
740	8	P585	PLS	30	11,400	5,900
741	8	P591	PLS	10	1,150	4,400
742	8	P592	PDO	10	890	880
743	8	P593	PDO	10	80	880
744	8	P594	PLS	20	340	2,400
745	8	P595	PLS	10	80	1,130
746	8	P596	PLS	10	60	190
747	8	P597	PLS	10	60	960
748	8	P598	PLS	10	50	280
749	8	P599	PLS	10	50	180
750	8	P600	PLS	10	80	290
751	8	P601	PLS	20	90	420
752	8	P602	PLS	10	50	90
753	8	P603	PLS	10	70	170
754	8	P604	PLS	10	130	120
755	8	P605	PLS	10	40	60
756	8	P606	PLS	10	40	150
757	8	P607	PDO	10	250	330
758	8	M303	PSS	10	60	20
759	8	M304	PLS	10	40	50
760	8	M306	PDO	10	60	90
761	8	M307	PDO	10	40	50
762	8	M308	PLS	10	50	60
763	8	M309	PDO	10	40	30
764	8	M310	PDO	30	30	20
765	8	M311	PDO	20	40	50
766	8	M312	PDO	10	30	30
767	8	M313	PLS	10	320	120
768	8	M314	PLS	10	790	130
769	8	M315	PLS	10	3,680	80
770	8	M316	PLS	10	200	120
771	8	M317	PLS	20	1,040	260
772	8	M318	PLS	10	90	800
773	8	M319	PDO	10	40	60
774	8	M320	PLS	10	120	820

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
775	8	M321	PLS	10	60	470
776	8	M322	PLS	10	80	540
777	8	M323	PLS	90	70	290
778	8	M326	PDO	10	40	20
779	8	M327	PSS	10	30	10
780	8	M328	PLS	10	340	20
781	8	M329	PLS	10	40	20
782	8	M332	PLS	30	40	20
783	8	M338	TR	20	30	10
784	10	M339	PLS	10	60	260
785	10	M340	PLS	10	110	170
786	10	M341	PLS	10	80	1,940
787	10	M342	PDO	10	50	190
788	10	M343	PLS	10	110	240
789	6	M362	PLS	10	40	370
790	6	M363	PLS	30	30	10
791	6	M364	PLS	10	80	20
792	6	M365	PLS	10	30	20
793	6	M366	PLS	10	30	40
794	6	M367	PLS	10	30	20
795	6	M368	PLS	10	30	50
796	6	M369	PDO	20	30	20
797	6	M370	PLS	10	490	390
798	6	M371	PLS	10	520	320
799	6	M372	PLS	20	750	2,650
800	22	M373	PSS	20	30	150
801	22	M374	PSS	10	30	50
802	22	M375	PSS	10	40	30
803	22	M376	PDO	10	30	10
804	22	M377	PDO	10	40	20
805	22	M378	PDO	10	40	10
806	22	M379	PSS	10	40	50
807	22	M380	PSS	10	40	40
808	22	M381	PSS	10	30	90
809	22	M382	PSS	30	30	200
810	22	M383	PSS	30	30	100
811	22	M384	PSS	10	30	170
812	22	M385	PSS	10	30	120
813	22	M386	PSS	10	30	330
814	22	M387	PSS	30	30	80
815	22	M388	PSS	20	40	130
816	22	M389	PDO	10	40	10
817	22	M390	PDO	10	40	10

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
818	22	M391	PDO	10	40	20
819	22	M392	PDO	10	40	20
820	22	M393	PDO	10	40	20
821	22	M394	PDO	10	40	20
822	22	M395	PDO	10	30	10
823	22	M396	PDO	10	40	20
824	22	M397	PLS	10	40	20
825	22	M398	PDO	20	30	10
826	22	M399	PSS	10	50	90
827	22	M400	PLS	10	40	20
828	22	M401	PDO	10	30	20
829	22	M402	PDO	10	30	20
930	22	M403	PDO	10	40	30
831	22	M404	PDO	10	40	50
832	22	M405	PDO	10	30	20
833	22	M406	PDO	20	40	60
834	22	M407	PDO	10	30	20
835	22	M408	PDO	10	30	20
836	22	M409	PLS	10	40	20
837	22	M410	PDO	10	30	20
838	22	M411	PDO	10	30	20
839	22	M412	PDO	10	30	20
840	22	M413	PDO	20	40	20
841	22	M414	PLS	10	30	20
842	22	M415	PDO	10	30	20
843	22	M416	PDO	10	30	10
844	22	M417	PDO	20	40	20
845	22	M418	PDO	10	30	20
846	22	M419	PDO	10	30	20
847	22	M420	PDO	20	30	10
848	22	M421	PLS	10	30	20
849	22	M422	PDO	10	30	10
850	22	M423	PDO	10	30	10
851	22	M424	PLS	10	40	20
852	22	M425	PDO	10	30	20
853	22	M426	PDO	10	30	20
854	11	M427	PDO	10	80	40
855	11	M428	PLS	10	60	50
856	11	M429	PLS	10	40	40
857	11	M430	PLS	10	40	150
858	11	M431	PLS	10	40	40
859	11	M432	PDO	10	40	130
860	11	M433	PLS	10	40	110

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
861	11	M434	PLS	10	40	30
862	11	M435	PDO	10	110	140
863	11	M436	PLS	10	50	50
864	11	M437	PLS	10	30	30
865	11	M438	PLS	10	40	40
866	11	M439	PLS	10	40	60
867	11	M440	PLS	10	40	20
868	11	M441	PLS	10	40	30
869	11	M442	PLS	10	40	70
870	11	M443	PLS	10	60	100
871	11	M444	PLS	10	50	70
872	10	M445	PLS	10	50	130
873	10	M446	PLS	10	90	320
874	10	M447	PLS	10	220	240
875	13	M452	PLS	10	40	20
876	13	M453	PLS	10	30	10
877	13	M454	PLS	10	30	20
878	13	M455	PLS	10	30	20
879	13	M456	PLS	10	40	20
880	13	M457	PLS	10	40	30
881	10	M458	PLS	10	340	920
882	10	M459	PLS	10	200	690
883	10	M460	PLS	10	30	60
884	10	M461	PLS	10	30	150
885	10	M462	PLS	10	40	50
886	10	M463	PLS	10	30	690
887	22	M464	PDO	10	40	20
888	22	M465	PDO	10	40	20
889	22	M466	PDO	10	30	10
890	22	M467	PDO	10	40	20
891	22	M468	PDO	10	40	20
892	22	M469	PDO	10	30	10
893	22	M470	PDO	10	30	10
894	22	M472	PDO	10	30	20
895	22	M473	PDO	10	40	20
896	22	M474	PDO	10	30	20
897	22	M475	PDO	10	30	10
898	22	M476	PDO	10	30	20
899	22	M477	PDO	10	60	20
900	9	M478	PLS	10	30	90
901	9	M479	PLS	10	30	60
902	9	M480	PLS	10	30	60
903	9	M481	PLS	10	30	30

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
904	9	M482	PDO	10	40	20
905	9	M483	PDO	10	30	20
906	9	M484	PDO	10	40	20
907	9	M485	PDO	10	30	20
908	9	M486	PDO	10	40	20
909	9	M487	PDO	10	30	20
910	9	M488	PDO	10	30	20
911	9	M489	PDO	10	30	20
912	9	M490	PDO	10	30	10
913	9	M491	PDO	10	30	20
914	9	M492	PDO	10	40	20
915	4	M495	PLS	10	490	2,950
916	4	M496	PLS	10	40	60
917	4	M497	PLS	10	300	370
918	9	M498	PDO	10	40	10
919	9	M499	PDO	10	40	10
920	9	M500	PDO	10	30	10
921	9	M501	PDO	30	30	10
922	9	M502	PDO	10	30	20
923	9	M503	PDO	10	50	20
924	9	M504	PDO	20	40	20
925	9	M505	PDO	10	30	10
926	9	M506	PDO	30	260	1,710
927	21	M508	PLS	10	210	210
928	21	M509	PLS	10	40	790
929	21	M510	PLS	10	40	220
930	23	L639	PDO	3	31	27
931	23	L640	PDO	18	35	26

A. I - 13. (2) Geochemical contents of 3-elements in soil of the detailed survey area

Geological Index

Sedimentary Rocks

Pucara Group

- PDO --- Dolimite
- PLS --- Limestone
- PSS --- Sandstone

Igneous rocks

Tertiary	Rhyolite & Dacite	TR
Cretaceous	Granite	CG
Jurassic	Diorite complex	MD

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
1841	10	ATA 001	PDO	24	155	1,710
1842	10	ATA 002	PLS	11	102	590
1843	10	ATA 003	PLS	38	58	198
1844	10	ATA 004	PLS	5	47	73
1845	10	ATA 005	PLS	24	42	86
1846	10	ATA 006	PLS	45	72	102
1847	10	ATA 007	PLS	11	17	46
1848	10	ATA 008	CG	10	29	48
1849	10	ATA 009	CG	47	12	37
1850	10	ATA 010	CG	16	10	43
1851	10	ATA 011	PDO	5	160	220
1852	10	ATA 012	PDO	43	137	135
1853	10	ATA 013	PLS	6	2,600	220
1854	10	ATA 014	PLS	5	21	28
1855	10	ATA 015	TR	5	12	15
1856	10	ATA 016	TR	5	26	25
1857	10	ATA 017	TR	6	31	36
1858	10	ATA 018	TR	7	30	54
1859	10	ATA 019	TR	7	23	35
1860	10	ATA 020	TR	8	22	42
1861	10	ATA 021	TR	7	23	36
1862	10	ATA 022	TR	14	27	59
1863	10	ATA 023	TR	20	44	170
1864	10	ATA 024	TR	24	33	59
1865	10	ATA 025	TR	7	19	24
1866	10	ATA 026	TR	5	8	16
1867	10	ATA 027	TR	8	21	33
1868	10	ATL 042	CG	13	64	95
1869	10	ATL 043	CG	21	46	198
1870	10	ATL 044	CG	20	34	109
1871	10	ATL 045	CG	39	45	270
1872	10	ATL 046	PLS	23	159	620
1873	10	ATL 047	PDO	23	141	260
1874	10	ATL 048	PLS	37	190	340
1875	10	ATL 049	PLS	27	35	156
1876	10	ATL 050	PSS	31	246	250
1877	10	ATL 051	PSS	19	76	109
1878	10	ATL 052	PSS	23	102	91
1879	10	ATL 053	PSS	59	52	69
1880	10	ATL 054	PSS	23	28	40
1881	10	ATL 055	PLS	121	39	80
1882	10	ATL 056	PSS	19	35	44
1883	10	ATL 057	PSS	18	580	1,260

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
1884	10	ATL 058	PSS	11	254	370
1885	10	ATL 059	PLS	23	660	1,070
1886	10	ATL 060	PLS	13	77	157
1887	10	ATL 061	PSS	22	450	56
1888	10	ATL 062	PLS	5	22	14
1889	10	ATL 063	PLS	21	162	320
1890	10	ATL 064	PLS	16	109	143
1891	10	ATL 065	PLS	5	56	61
1892	10	ATL 066	PLS	8	40	20
1893	10	ATL 067	PLS	10	58	38
1894	10	ATL 068	PLS	42	75	260
1895	10	ATL 069	PLS	8	45	29
1896	10	ATL 070	PLS	5	177	270
1897	10	ATL 071	PLS	7	80	108
1898	10	ATL 072	PLS	10	152	155
1899	10	ATL 073	PLS	5	28	13
1900	10	ATL 074	PLS	10	60	92
1901	10	ATL 075	PLS	7	48	16
1902	10	ATL 076	PLS	5	25	10
1903	10	ATL 077	PLS	27	126	52
1904	10	ATL 078	PLS	21	83	58
1905	10	ATL 079	PLS	23	148	98
1906	10	ATL 080	PLS	10	114	87
1907	10	ATL 081	PLS	5	38	8
1908	10	ATL 082	PLS	13	52	21
1909	10	ATL 083	PLS	17	76	37
1910	13	ATL 084	PLS	5	33	5
1911	10	ATL 085	PLS	16	74	40
1912	10	ATL 086	PLS	11	57	22
1913	10	ATL 087	PLS	27	220	21
1914	10	ATL 088	PLS	18	200	85
1915	10	ATL 089	PLS	16	144	58
1916	10	ATL 090	PLS	19	181	74
1917	10	ATL 091	PLS	5	16	18
1918	10	ATL 092	PLS	13	123	87
1919	10	ATL 093	PLS	5	36	9
1920	10	ATL 094	PLS	6	66	46
1921	10	ATL 095	TR	13	400	43
1922	10	ATL 096	TR	5	25	28
1923	10	ATL 097	TR	5	20	12
1924	10	ATL 098	TR	5	31	46
1925	10	ATL 099	TR	5	23	11
1926	13	ATL 100	TR	5	22	5

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
1927	13	ATL 101	TR	5	30	37
1928	13	ATL 102	TR	5	30	57
1929	13	ATL 103	TR	5	31	67
1930	13	ATL 104	TR	5	32	38
1931	13	ATL 105	TR	5	51	24
1932	13	ATL 106	TR	5	22	58
1933	13	ATL 107	TR	8	50	51
1934	13	ATL 108	TR	12	32	43
1935	13	ATL 109	TR	6	40	48
1936	13	ATL 110	TR	7	46	57
1937	13	ATL 111	TR	7	31	84
1938	13	ATL 112	TR	5	34	38
1939	10	ATL 113	PLS	13	37	126
1940	10	ATL 114	PLS	6	98	143
1941	10	ATL 115	PLS	9	28	320
1942	10	ATL 116	PLS	9	81	1,070
1943	10	ATL 117	PLS	14	165	720
1944	10	ATL 118	PLS	12	87	480
1945	10	ATL 119	PLS	10	170	670
1946	10	ATL 120	PLS	8	600	2,410
1947	10	ATL 121	PLS	14	148	1,040
1948	10	ATL 122	PLS	10	105	500
1949	10	ATL 123	PLS	9	182	2,500
1950	10	ATL 124	PLS	17	61	187
1951	10	ATL 125	PLS	21	750	470
1952	10	ATL 126	PLS	34	180	1,220
1953	10	ATL 127	PLS	7	33	130
1954	10	ATL 128	PDO	11	260	2,640
1955	10	ATL 129	PLS	12	210	1,600
1956	10	ATL 130	TR	6	103	145
1957	10	ATL 131	TR	5	15	19
1958	10	ATM 001	PSS	5	21	12
1959	10	ATM 002	PLS	5	191	20
1960	10	ATM 003	PLS	5	450	170
1961	10	ATM 004	TR	5	22	35
1962	8	ATM 005	TR	5	5	27
1963	8	ATM 006	TR	5	5	7
1964	8	ATM 007	TR	5	18	25
1965	8	ATM 008	TR	5	17	13
1966	8	ATM 009	TR	5	10	33
1967	8	ATM 010	TR	5	12	18
1968	10	ATM 011	PLS	5	69	185
1969	10	ATM 012	PLS	5	115	370

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
1970	10	ATM 013	PDO	12	210	640
1971	10	ATM 014	PDO	13	133	1,020
1972	10	ATM 015	PDO	18	84	8,280
1973	10	ATM 016	PSS	7	106	1,580
1974	10	ATM 017	PSS	19	360	2,220
1975	10	ATM 018	PSS	5	100	155
1976	10	ATM 019	PSS	5	76	235
1977	10	ATM 020	PSS	43	90	910
1978	10	ATM 022	PSS	5	12	7
1979	10	ATM 023	PSS	5	16	12
1980	8	ATM 024	PSS	5	21	23
1981	8	ATM 025	PSS	5	15	9
1982	8	ATM 026	PSS	16	12	21
1983	8	ATM 027	PSS	5	13	17
1984	8	ATM 028	PSS	5	14	10
1985	8	ATM 029	PSS	5	15	5
1986	8	ATM 030	PSS	39	60	440
1987	8	ATM 031	PSS	5	16	17
1988	8	ATM 032	PSS	12	26	10
1989	8	ATM 033	PSS	5	9	5
1990	8	ATM 034	PLS	5	10	6
1991	8	ATM 035	PLS	5	12	18
1992	8	ATM 036	PLS	5	6	5
1993	8	ATM 037	PLS	8	42	36
1994	8	ATM 038	PLS	5	17	16
1995	8	ATM 039	PLS	5	5	5
1996	8	ATM 040	PLS	5	5	5
1997	8	ATM 041	PLS	8	28	66
1998	8	ATM 042	PLS	5	33	72
1999	8	ATM 043	PLS	5	23	39
2000	8	ATM 044	PLS	5	366	41
2001	8	ATM 045	PLS	7	1,000	1,550
2002	8	ATM 046	PLS	7	380	283
2003	8	ATM 047	PLS	5	64	88
2004	8	ATM 048	PLS	7	60	52
2005	8	ATM 049	PLS	5	48	64
2006	8	ATM 050	PSS	5	8	5
2007	8	ATM 051	PSS	25	41	264
2008	8	ATM 052	PSS	7	39	94
2009	8	ATM 053	PSS	5	16	15
2010	8	ATM 054	PSS	12	40	273
2011	8	ATM 056	PSS	5	10	13
2012	13	ATM 059	PLS	20	29	266

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
2013	13	ATM 059	PLS	16	32	123
2014	13	ATM 060	PLS	5	31	40
2015	13	ATM 061	PLS	9	29	44
2016	13	ATM 062	PLS	7	49	105
2017	13	ATM 063	PLS	7	68	39
2018	13	ATM 064	PLS	5	41	65
2019	13	ATM 065	PLS	5	44	35
2020	13	ATM 066	PLS	5	39	46
2021	13	ATM 067	PLS	5	5	5
2022	13	ATM 068	PLS	5	5	5
2023	13	ATM 069	PLS	5	26	8
2024	13	ATM 070	PLS	5	31	125
2025	13	ATM 072	PLS	13	12	15
2026	13	ATM 073	PLS	12	23	39
2027	13	ATM 074	CO	163	100	129
2028	13	ATM 075	PLS	56	88	151
2029	13	ATM 076	CO	22	29	47
2030	13	ATM 077	CO	58	150	225
2031	13	ATM 078	CO	62	98	174
2032	13	ATM 079	CO	66	94	248
2033	13	ATM 080	MD	59	86	133
2034	13	ATM 081	PLS	47	78	87
2035	13	ATM 082	PLS	44	71	133
2036	13	ATM 083	CO	21	36	101
2037	13	ATM 084	CO	5	10	14
2038	13	ATM 085	CO	7	16	24
2039	13	ATM 086	CO	6	14	17
2040	10	ATM 087	CO	15	100	119
2041	10	ATM 088	CO	12	68	63
2042	10	ATM 089	PLS	22	323	333
2043	10	ATM 090	PLS	69	2,040	2,720
2044	10	ATM 091	PLS	11	318	407
2045	10	ATM 092	PLS	38	594	395
2046	10	ATM 093	PLS	42	840	2,060
2047	10	ATM 094	PLS	15	291	1,330
2048	10	ATM 095	PLS	22	88	600
2049	10	ATM 096	PLS	150	4,200	12,100
2050	10	ATM 097	PLS	7	230	1,650
2051	10	ATM 098	PLS	15	490	2,620
2052	10	ATM 099	PLS	5	84	207
2053	10	ATM 100	PLS	5	40	140
2054	8	ATP 001	PSS	5	36	31
2055	8	ATP 002	PLS	5	42	75

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
2056	8	ATP 003	TR	22	72	88
2057	8	ATP 004	TR	5	27	38
2058	8	ATP 005	TR	5	5	5
2059	8	ATP 006	TR	5	9	16
2060	8	ATP 007	TR	5	7	12
2061	8	ATP 008	TR	5	34	39
2062	8	ATP 009	TR	5	25	44
2063	8	ATP 010	TR	12	58	105
2064	8	ATP 011	TR	5	42	57
2065	10	ATP 012	PLS	5	135	455
2066	10	ATP 013	PLS	5	98	330
2067	10	ATP 014	PLS	9	92	270
2068	10	ATP 015	PLS	8	155	690
2069	10	ATP 016	PLS	12	128	480
2070	10	ATP 017	PLS	32	29	81
2071	10	ATP 018	PLS	5	27	30
2072	10	ATP 116	PLS	14	40	70
2073	10	ATP 117	PLS	5	49	45
2074	13	ATP 118	PLS	20	70	129
2075	13	ATP 119	PDO	15	94	106
2076	13	ATP 120	PDO	17	130	76
2077	13	ATP 121	PLS	18	125	81
2078	13	ATP 122	PLS	16	88	87
2079	13	ATP 123	PDO	18	118	63
2080	13	ATP 124	PDO	5	22	5
2081	13	ATP 125	PDO	5	50	11
2082	13	ATP 126	PLS	5	7	7
2083	13	ATP 127	PLS	5	11	5
2084	10	ATP 128	PDO	16	65	304
2085	10	ATP 129	PLS	6	100	2,040
2086	10	ATP 130	PLS	28	318	14,700
2087	10	ATP 131	PLS	59	810	10,200
2088	10	ATP 132	TR	17	740	1,500
2089	10	ATP 133	TR	5	17	45
2090	10	ATP 134	TR	5	13	35
2091	10	ATP 135	PLS	5	54	154
2092	10	ATP 136	PLS	14	88	371
2093	10	ATP 137	PLS	9	71	300
2094	10	ATP 138	PLS	5	63	105

A. I - 13. (3) Geochemical contents of 3-elements in soil of the semi-detailed survey area

Geological Index

Sedimentary rocks		
Quaternary (gravel & sand)		QU
Chonta Group		CH
Oriente Group		OR
Sarayaquillo Formation		SA
Pucara Group		PU
Mitu Group		MI
Igneous rocks		
Tertiary	Volcanics	TV
Cretaceous~Tertiary	Quartz porphyry & Granite porphyry	MP

TINGO MARIA

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
1	B18	BTA 131	CH	26	48	73
2	B18	BTA 132	CH	23	68	83
3	B18	BTA 133	CH	28	49	56
4	B18	BTA 134	CH	25	46	74
5	B18	BTA 135	CH	33	67	111
6	B18	BTA 136	CH	45	42	68
7	B18	BTA 137	CH	27	33	67
8	B18	BTA 138	CH	31	37	71
9	B18	BTA 139	CH	25	39	61
10	B18	BTA 140	PU	20	40	60
11	B18	BTA 141	PU	23	36	167
12	B18	BTA 142	PU	29	125	67
13	B18	BTA 143	PU	20	45	160
14	B18	BTA 144	PU	43	127	297
15	B18	BTA 145	PU	35	35	242
16	B18	BTA 146	PU	37	35	181
17	B18	BTA 149	PU	51	46	216
18	B18	BTA 150	PU	25	31	63
19	B18	BTA 151	PU	36	54	252
20	B18	BTA 152	PU	30	29	291
21	B18	BTA 153	PU	74	98	1,303
22	B18	BTA 154	PU	43	47	167
23	B18	BTA 155	PU	36	61	191
24	B18	BTA 156	PU	30	43	95
25	B18	BTA 157	PU	42	92	293
26	B18	BTA 158	PU	47	36	150
27	B18	BTA 159	PU	40	36	128
28	B18	BTA 160	PU	23	23	71
29	B18	BTA 161	PU	21	16	43
30	B18	BTC 001	CH	66	23	19
31	B18	BTC 002	CH	60	22	181
32	B18	BTC 003	CH	82	27	13
33	B18	BTC 004	CH	46	19	15
34	B18	BTC 005	CH	75	28	27
35	B18	BTC 006	CH	85	34	18
36	B18	BTC 008	CH	87	34	24
37	B18	BTC 010	CH	63	29	27
38	B18	BTC 011	CH	65	32	32
39	B18	BTC 012	CH	94	35	18
40	B18	BTC 013	CH	20	30	57
41	B18	BTC 014	CH	23	25	47
42	B18	BTC 016	CH	16	37	61
43	B18	BTC 017	CH	12	34	57

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
44	B18	BTC 019	CH	14	50	43
45	B19	BTC 020	CH	15	33	50
46	B19	BTC 021	CH	15	32	45
47	B19	BTC 022	CH	19	31	113
48	B19	BTC 023	CH	14	26	130
49	B18	BTC 024	PU	59	4,138	423
50	B18	BTC 025	CH	17	33	61
51	B18	BTC 026	CH	21	32	63
52	B19	BTI 031	PU	49	32	936
53	B19	BTI 032	PU	36	159	561
54	B19	BTI 033	PU	29	81	172
55	B19	BTI 034	PU	28	56	88
56	B19	BTI 035	PU	27	78	202
57	B19	BTI 036	PU	22	30	88
58	B19	BTI 037	OR	34	34	256
59	B19	BTI 038	CH	17	42	81
60	B19	BTI 039	CH	18	44	71
61	B19	BTI 040	CH	24	49	91
62	B19	BTI 041	PU	37	34	246
63	B19	BTI 042	CH	14	21	58
64	B19	BTI 043	CH	21	22	51
65	B19	BTI 044	PU	15	25	55
66	B19	BTI 045	CH	22	24	35
67	B19	BTI 046	PU	14	225	803
68	B19	BTI 047	PU	13	32	60
69	B19	BTI 048	PU	23	28	139
70	B19	BTI 049	PU	37	58	204
71	B19	BTI 050	PU	37	105	395
72	B19	BTI 051	PU	34	115	291
73	B19	BTI 052	PU	27	34	179
74	B19	BTI 053	PU	17	24	82
75	B19	BTI 054	PU	25	57	197
76	B19	BTI 055	PU	28	80	356
77	B19	BTI 056	PU	37	54	303
78	B19	BTI 057	PU	36	144	489
79	B19	BTI 058	OR	51	34	70
80	B19	BTI 059	CH	22	49	82
81	B19	BTI 060	CH	13	37	31
82	B19	BTI 061	CH	25	33	73
83	B19	BTI 062	CH	15	16	68
84	B19	BTI 063	PU	25	28	185
85	B19	BTI 064	PU	21	69	323
86	B19	BTI 065	PU	18	15	43

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
87	B19	BTI 066	PU	30	46	109
88	B19	BTI 067	PU	14	12	21
89	B19	BTI 068	PU	19	21	30
90	B19	BTI 069	PU	15	15	24
91	B19	BTI 070	PU	17	16	26
92	B19	BTI 071	PU	9	9	18
93	B19	BTI 072	PU	12	15	20
94	B19	BTI 073	PU	10	16	17
95	B19	BTI 074	PU	29	15	103
96	B19	BTI 075	QU	29	18	98
97	B19	BTI 076	QU	25	21	62
98	B19	BTI 077	QU	22	17	50
99	B19	BTI 078	QU	17	13	35
100	B19	BTI 079	QU	16	15	27
101	B19	BTI 080	QU	16	14	37
102	B19	BTI 081	QU	19	18	42
103	B19	BTI 093	PU	22	54	564
104	B19	BTI 094	PU	12	8	51
105	B19	BTI 095	PU	33	21	415

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)

HUANCABAMBA

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
106	HC	BTA 028	PU	39	4,975	1,350
107	HC	BTA 029	PU	8	43	52
108	HC	BTA 030	PU	14	24	45
109	HC	BTA 031	PU	7	18	18
110	HC	BTA 032	PU	8	675	45
111	HC	BTA 033	PU	22	6,825	6,700
112	HC	BTA 034	PU	19	613	455
113	HC	BTA 035	PU	27	2,188	618
114	HC	BTA 036	PU	27	5,525	1,988
115	HC	BTA 037	PU	29	2,720	694
116	HC	BTA 038	TV	29	2,050	568
117	HC	BTA 039	TV	15	38	123
118	HC	BTA 040	TV	17	40	47
119	HC	BTA 041	TV	13	82	173
120	HC	BTA 042	TV	39	88	43
121	HC	BTA 043	TV	46	70	263
122	HC	BTA 044	PU	19	61	143
123	HC	BTA 045	PU	20	94	282
124	HC	BTA 046	PU	37	142	38
125	HC	BTA 047	PU	24	100	251
126	HC	BTA 048	MP	19	5,188	150
127	HC	BTA 049	MP	22	58	107
128	HC	BTA 050	MP	20	25	43
129	HC	BTA 051	MP	17	17	35
130	HC	BTA 052	MP	9	6	18
131	HC	BTA 053	MP	33	101	133
132	HC	BTA 054	PU	19	47	153
133	HC	BTA 055	PU	14	38	81
134	HC	BTA 056	PU	16	20	104
135	HC	BTP 025	OR	13	86	308
136	HC	BTP 026	OR	10	156	121
137	HC	BTP 027	OR	20	70	47
138	HC	BTP 029	OR	58	165	798
139	HC	BTP 031	OR	23	226	660
140	HC	BTP 032	OR	41	210	658
141	HC	BTP 033	OR	37	220	1,100
142	HC	BTP 034	OR	23	169	526
143	HC	BTP 035	OR	22	298	405
144	HC	BTP 036	OR	24	330	621
145	HC	BTP 037	OR	24	1,118	1,178
146	HC	BTP 038	OR	25	420	868
147	HC	BTP 039	OR	38	1,981	2,753
148	HC	BTP 040	PU	21	11,575	3,990

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
149	HC	BTP 041	PU	23	315	823
150	HC	BTP 042	PU	19	53	100
151	HC	BTP 043	OR	19	25	65
152	HC	BTP 045	OR	13	23	56
153	HC	BTP 047	OR	16	89	94
154	HC	BTP 049	OR	18	680	396
155	HC	BTP 051	OR	18	35	190
156	HC	BTP 053	OR	18	1,108	500
157	HC	BTP 055	OR	17	6	25
158	HC	BTP 056	OR	16	12	15
159	HC	BTP 057	OR	15	9	20
160	HC	BTP 058	OR	19	16	88
161	HC	BTP 059	OR	20	19	88
162	HC	BTP 060	OR	25	26	74
163	HC	BTP 061	OR	17	17	49
164	HC	BTP 062	OR	21	27	85
165	HC	BTP 063	PU	24	34	65
166	HC	BTP 064	PU	18	18	65
167	HC	BTP 065	PU	28	24	178
168	HC	BTP 066	PU	31	178	470
169	HC	BTP 067	PU	21	38	170
170	HC	BTP 068	PU	21	17	104
171	HC	BTP 069	PU	21	41	111
172	HC	BTP 070	PU	26	85	142
173	HC	BTP 071	PU	27	118	315
174	HC	BTP 072	PU	30	101	645
175	HC	BTP 073	PU	15	12	25
176	HC	BTP 074	PU	15	9	27
177	HC	BTP 075	PU	29	5	238
178	HC	BTP 076	OR	28	6	200
179	HC	BTP 077	OR	32	22	360
180	HC	BTP 078	OR	32	15	315
181	HC	BTP 079	OR	30	10	260
182	HC	BTP 080	OR	42	1,003	2,105
183	HC	BTP 081	PU	31	9	26
184	HC	BTP 082	PU	54	40	430
185	HC	BTP 083	PU	54	40	525
186	HC	BTP 085	PU	445	16	378
187	HC	BTP 086	PU	57	22	31
188	HC	BTP 087	PU	50	25	61
189	HC	BTP 088	PU	69	56	1,443
190	HC	BTP 089	PU	25	28	58
191	HC	BTP 090	PU	24	12	29

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
192	HC	BTP 091	PU	31	17	25
193	HC	BTP 092	PU	223	200	68
194	HC	BTP 093	PU	92	39	101
195	HC	BTP 094	MI	32	8	200
196	HC	BTP 095	MI	34	22	60
197	HC	BTP 096	MI	34	18	58
198	HC	BTP 097	MI	33	30	51
199	HC	BTP 098	MI	29	6	25
200	HC	BTP 099	PU	30	12	37
201	HC	BTP 100	PU	33	10	29
202	HC	BTP 101	MI	52	30	31
203	HC	BTP 102	MI	30	8	27
204	HC	BTP 103	PU	26	6	26
205	HC	BTP 104	PU	25	8	25
206	HC	BTP 105	PU	58	23	46
207	HC	BTP 106	PU	128	37	75
208	HC	BTP 107	PU	50	21	39
209	HC	BTP 108	PU	45	15	40
210	HC	BTP 109	PU	107	37	65
211	HC	BTP 110	PU	52	25	73
212	HC	BTP 111	MI	51	31	79
213	HC	BTP 112	MI	42	22	59
214	HC	BTP 113	MI	47	22	53
215	HC	BTP 114	MI	495	30	63
216	HC	BTP 115	MI	625	36	62

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)

RIO SANTA CRUZ

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
217	SC	BTA 176	PU	32	26	37
218	SC	BTA 177	PU	33	29	42
219	SC	BTA 178	PU	30	28	38
220	SC	BTA 179	PU	26	22	45
221	SC	BTA 180	PU	24	18	32
222	SC	BTA 181	PU	30	13	36
223	SC	BTA 182	PU	20	15	31
224	SC	BTA 183	PU	18	7	20
225	SC	BTA 184	PU	19	18	35
226	SC	BTA 185	PU	33	22	86
227	SC	BTA 186	PU	20	14	32
228	SC	BTA 187	PU	18	19	34
229	SC	BTA 188	PU	17	19	37
230	SC	BTA 189	PU	17	6	25
231	SC	BTA 190	PU	97	29	76
232	SC	BTA 191	PU	20	19	41
233	SC	BTA 192	PU	25	21	45
234	SC	BTA 193	PU	21	16	53
235	SC	BTA 194	PU	20	11	28
236	SC	BTA 195	PU	19	17	28
237	SC	BTA 196	PU	24	27	80
238	SC	BTA 197	PU	25	28	64
239	SC	BTA 198	PU	26	23	148
240	SC	BTA 199	PU	28	30	159

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)

RAYMONDI

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
241	RY	BTC 030	PU	35	23	148
242	RY	BTC 031	PU	40	89	291
243	RY	BTC 032	PU	36	34	207
244	RY	BTC 033	PU	36	45	269
245	RY	BTC 034	PU	27	26	223
246	RY	BTC 035	PU	37	29	315
247	RY	BTC 036	PU	41	32	297
248	RY	BTC 037	PU	25	32	49
249	RY	BTC 038	CH	45	32	43
250	RY	BTC 039	CH	21	30	34
251	RY	BTC 040	PU	26	30	41
252	RY	BTC 041	PU	72	42	70
253	RY	BTC 042	PU	54	26	74
254	RY	BTC 043	CH	37	15	57
255	RY	BTC 044	PU	35	24	343
256	RY	BTC 045	SA	24	33	51
257	RY	BTC 046	SA	26	31	38
258	RY	BTC 047	PU	39	71	210
259	RY	BTC 048	PU	47	29	306
260	RY	BTC 049	PU	54	28	337
261	RY	BTC 050	PU	38	27	369
262	RY	BTC 051	CH	44	19	85
263	RY	BTC 052	CH	24	19	39
264	RY	BTC 053	CH	28	36	82
265	RY	BTC 054	CH	24	50	76
266	RY	BTC 055	CH	31	13	54
267	RY	BTC 056	CH	40	25	58
268	RY	BTC 057	CH	25	19	46
269	RY	BTC 058	CH	26	23	56
270	RY	BTC 059	CH	28	43	56
271	RY	BTC 060	CH	35	25	42
272	RY	BTC 061	CH	22	17	41
273	RY	BTC 062	CH	23	17	72
274	RY	BTC 063	CH	24	26	73
275	RY	BTC 064	OR	30	18	43
276	RY	BTC 065	OR	29	23	35
277	RY	BTC 066	OR	35	21	59
278	RY	BTC 067	OR	40	24	73
279	RY	BTC 068	OR	37	23	72
280	RY	BTC 069	CH	55	19	75
281	RY	BTC 070	CH	33	132	708
282	RY	BTC 071	CH	42	31	105
283	RY	BTC 072	CH	25	24	53

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Pb (ppm)	Zn (ppm)
284	RY	BTM 001	PU	23	27	92
285	RY	BTM 002	PU	32	57	137
286	RY	BTM 003	PU	41	20	110
287	RY	BTM 004	PU	35	35	154
288	RY	BTM 005	PU	21	40	85
289	RY	BTM 006	PU	40	39	140
290	RY	BTM 007	PU	30	35	127
291	RY	BTM 008	PU	46	39	168
292	RY	BTM 009	PU	31	31	184
293	RY	BTM 010	PU	22	37	154
294	RY	BTM 011	PU	28	44	115
295	RY	BTM 012	PU	21	26	203
296	RY	BTM 013	PU	21	19	56
297	RY	BTM 014	PU	28	20	67
298	RY	BTM 015	PU	19	17	41
299	RY	BTM 016	PU	23	28	31
300	RY	BTM 017	CH	17	14	23
301	RY	BTM 018	CH	19	13	21
302	RY	BTM 019	CH	17	15	33
303	RY	BTM 020	CH	89	36	81
304	RY	BTM 021	CH	52	43	12
305	RY	BTM 022	CH	24	18	34
306	RY	BTM 023	CH	38	26	48
307	RY	BTM 024	CH	23	9	25
308	RY	BTM 025	PU	39	37	35
309	RY	BTM 026	PU	25	25	54
310	RY	BTM 027	PU	32	41	82
311	RY	BTM 028	PU	27	30	75
312	RY	BTM 029	PU	42	44	83
313	RY	BTM 030	PU	30	40	87
314	RY	BTM 031	PU	21	30	49
315	RY	BTM 032	PU	29	37	57

A. I - 13. (4) Geochemical contents of 3-elements in soil of the reconnaissance area

Geological Index

Sedimentary rocks

Chonta Group		CH
Oriente Group		OR
Sarayaquillo Formation		SA
Pucara Group		PU
Mitu Group		MI

Igneous rocks

Jurassic	Diorite complex	MD

RIO HUALLAGA

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Zn(ppm)	Ni (ppm)
4298	14C	CTA 057	PU	35	168	133
4299	14C	CTA 058	PU	20	174	106
4300	14C	CTA 059	PU	21	164	143
4301	14C	CTA 060	PU	21	211	94
4302	14C	CTA 061	PU	20	217	77
4303	14C	CTA 062	PU	41	195	97
4304	14C	CTA 063	PU	26	167	126
4305	14C	CTA 065	PU	24	297	90
4306	14C	CTA 066	PU	18	187	83
4307	14C	CTA 068	PU	30	157	159
4308	14C	CTA 070	PU	5	14	8
4309	13C	CTA 072	PU	7	59	43
4310	13C	CTA 074	PU	8	69	17
4311	13C	CTA 076	PU	20	111	49
4312	13C	CTA 078	PU	3	129	24
4313	13C	CTA 080	PU	6	42	23
4314	13C	CTA 081	PU	23	162	113
4315	13C	CTA 082	PU	35	408	284
4316	13C	CTA 083	PU	0	660	33
4317	13C	CTA 084	PU	2	43	8
4318	14C	CTA 085	PU	22	145	108
4319	14C	CTA 086	PU	26	179	120
4320	14C	CTA 087	PU	36	195	230
4321	14C	CTA 088	PU	24	366	96
4322	14C	CTA 089	PU	55	463	103
4323	14C	CTA 090	PU	42	379	102
4324	14C	CTA 091	PU	11	432	49
4325	14C	CTA 092	PU	9	247	52
4326	14C	CTA 093	PU	12	336	86
4327	14C	CTA 094	PU	21	307	61
4328	14C	CTA 095	PU	16	344	55
4329	14C	CTA 096	PU	10	212	33
4330	14C	CTA 097	PU	34	820	78
4331	14C	CTA 098	PU	31	1,013	49
4332	14C	CTA 099	PU	11	469	31
4333	14C	CTA 100	PU	11	275	60
4334	14C	CTA 101	PU	26	368	115
4335	14C	CTA 102	PU	26	371	85
4336	14C	CTA 103	PU	33	489	149
4337	14C	CTA 104	PU	11	228	47
4338	14C	CTA 105	PU	18	281	73
4339	14C	CTA 106	PU	14	216	51
4340	14C	CTA 107	PU	12	198	40

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Zn(ppm)	Ni (ppm)
4341	14C	CTA 108	PU	27	339	40
4342	14C	CTA 109	PU	203	1,260	46
4343	14C	CTA 110	PU	30	406	102
4344	14C	CTA 111	PU	29	476	102
4345	14C	CTA 112	PU	26	445	95
4346	14C	CTA 113	PU	22	377	76
4347	14C	CTA 114	PU	13	433	34
4348	14C	CTA 115	PU	12	482	31
4349	13C	CTA 121	PU	10	173	45
4350	13C	CTA 122	PU	4	19	9
4351	13C	CTA 124	PU	2	224	20
4352	13C	CTA 125	PU	7	147	13
4353	13C	CTA 126	PU	0	297	9
4354	13C	CTA 128	PU	1	320	35
4355	13C	CTA 129	PU	0	97	8
4356	13C	CTA 130	PU	4	611	20
4357	17B	CTA 162	PU	16	84	35
4358	17B	CTA 163	PU	10	177	44
4359	17B	CTA 164	PU	14	294	95
4360	17B	CTA 165	PU	2	36	13
4361	17B	CTA 166	PU	8	97	24
4362	17B	CTA 167	PU	12	163	30
4363	17B	CTA 168	PU	8	152	25
4364	17B	CTA 169	PU	7	57	16
4365	17B	CTA 170	PU	11	164	35
4366	17B	CTA 171	PU	11	144	32
4367	17B	CTA 172	PU	34	365	59
4368	16B	CTC 001	PU	21	120	56
4369	16B	CTC 002	CH	5	34	18
4370	16B	CTC 004	OR	14	116	13
4371	16B	CTC 005	CH	19	40	33
4372	16B	CTC 006	CH	9	72	17
4373	16B	CTC 007	PU	22	111	34
4374	15C	CTC 008	PU	32	358	66
4375	15C	CTC 009	PU	21	345	61
4376	15C	CTC 010	PU	17	307	61
4377	15C	CTC 011	PU	38	257	67
4378	15C	CTC 012	PU	33	219	68
4379	15C	CTC 013	PU	24	119	43
4380	15C	CTC 014	PU	61	123	318
4381	15C	CTC 015	PU	17	210	58
4382	15C	CTC 016	PU	42	97	34
4383	15C	CTC 017	PU	25	238	82

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Zn (ppm)	Ni (ppm)
4384	15C	CTC 019	PU	32	364	128
4385	15C	CTC 022	PU	45	302	109
4386	15C	CTC 023	MI	26	316	83
4387	15C	CTC 024	MI	55	191	308
4388	15C	CTC 025	PU	4	95	11
4389	15C	CTC 026	PU	14	277	54
4390	15C	CTC 027	PU	12	281	32
4391	15C	CTC 029	PU	29	222	100
4392	14C	CTC 030	PU	14	175	52
4393	14C	CTC 032	PU	7	95	29
4394	14C	CTC 034	PU	28	307	104
4395	14C	CTC 036	PU	18	159	59
4396	17B	CTC 037	PU	53	195	57
4397	17B	CTC 038	PU	32	149	55
4398	17B	CTC 039	SA	8	65	24
4399	17B	CTC 041	CH	22	92	29
4400	17B	CTC 042	CH	10	51	24
4401	17B	CTC 043	CH	11	89	28
4402	17B	CTC 045	CH	5	35	13
4403	18B	CTC 046	PU	17	170	25
4404	18A	CTC 047	PU	12	107	22
4405	18A	CTC 048	PU	39	369	115
4406	18A	CTC 049	PU	9	78	38
4407	18A	CTC 050	PU	4	48	17
4408	16B	CTI 001	PU	31	356	75
4409	16B	CTI 002	PU	32	551	112
4410	16B	CTI 003	PU	20	119	29
4411	16B	CTI 004	CH	16	147	39
4412	16B	CTI 005	CH	10	103	25
4413	16B	CTI 006	CH	115	107	56
4414	16B	CTI 007	CH	10	134	34
4415	16B	CTI 008	PU	16	93	25
4416	15C	CTI 009	PU	29	31	36
4417	15C	CTI 010	PU	21	71	29
4418	15C	CTI 011	PU	66	139	110
4419	15C	CTI 012	PU	16	156	50
4420	15C	CTI 013	PU	10	78	27
4421	15C	CTI 014	PU	31	143	60
4422	15C	CTI 015	PU	25	236	101
4423	15C	CTI 016	PU	29	470	102
4424	15C	CTI 017	PU	27	113	55
4425	15C	CTI 018	PU	22	183	50
4426	15C	CTI 019	PU	28	257	45

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Zn (ppm)	Ni (ppm)
4427	15C	CTI 020	PU	28	402	75
4428	15C	CTI 021	PU	7	46	21
4429	14B	CTI 022	MI	10	46	24
4430	14B	CTI 023	MI	42	100	38
4431	14B	CTI 024	MI	61	135	45
4432	14B	CTI 025	MI	10	46	8
4433	14B	CTI 026	MI	16	54	2
4434	14B	CTI 027	MI	3	50	5
4435	14B	CTI 028	MI	4	45	3
4436	14B	CTI 029	MI	5	26	6
4437	14B	CTI 030	MI	3	18	4
4438	17B	CTI 082	PU	20	140	41
4439	17B	CTI 083	PU	27	140	53
4440	17B	CTI 084	PU	11	253	102
4441	17B	CTI 085	PU	13	27	15
4442	16B	CTI 086	PU	24	100	32
4443	16B	CTI 087	PU	19	128	52
4444	16B	CTI 088	PU	12	81	33
4445	16B	CTI 089	MI	31	92	31
4446	16B	CTI 090	PU	2	14	17
4447	16B	CTI 091	PU	3	14	17
4448	16B	CTI 092	PU	10	29	37

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Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Zn (ppm)	Ni (ppm)
4449	13D	CTL 001	MI	35	186	31
4450	13D	CTL 002	MI	27	156	33
4451	13D	CTL 003	MI	15	105	13
4452	13D	CTL 004	MI	12	87	13
4453	13D	CTL 005	MI	28	51	9
4454	13D	CTL 006	MI	7	45	3
4455	13D	CTL 007	MI	5	29	3
4456	13D	CTL 008	MI	5	34	1
4457	13D	CTL 009	MI	3	7	0
4458	13D	CTL 010	MI	69	90	32
4459	13D	CTL 011	MI	48	56	34
4460	13D	CTL 012	MI	11	35	4
4461	13D	CTL 013	MI	27	28	15
4462	13D	CTL 014	MI	71	98	23
4463	13D	CTL 015	MI	12	50	12
4464	13D	CTL 016	MI	15	41	10
4465	13D	CTL 017	MI	11	26	4
4466	12D	CTL 018	PU	35	348	115
4467	12D	CTL 020	PU	12	94	34
4468	12D	CTL 021	PU	13	268	94
4469	12D	CTL 024	PU	52	154	61
4470	12D	CTL 025	PU	27	309	96
4471	12D	CTL 026	PU	36	523	112
4472	12D	CTL 027	PU	32	105	17
4473	12D	CTL 028	PU	29	113	23
4474	12D	CTL 029	PU	23	71	15
4475	12D	CTL 030	PU	16	49	10
4476	12D	CTL 031	PU	31	264	84
4477	12D	CTL 032	PU	31	229	71
4478	12D	CTL 033	PU	23	114	31
4479	12D	CTL 034	PU	22	101	29
4480	12D	CTL 035	PU	28	142	84
4481	12D	CTL 036	MI	21	241	78
4482	12E	CTL 037	PU	16	281	68
4483	12E	CTL 038	PU	25	264	89
4484	12E	CTL 039	PU	21	216	64
4485	12E	CTL 040	PU	20	277	75
4486	12E	CTL 041	PU	21	302	50
4487	13D	CTM 001	PU	32	149	29
4488	13D	CTM 002	PU	49	162	26
4489	13D	CTM 003	MI	16	60	9
4490	13D	CTM 004	MI	25	81	13
4491	13D	CTM 005	MI	8	56	6

Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Zn (ppm)	Ni (ppm)
4492	13D	CTM 006	PU	11	43	10
4493	13D	CTM 007	PU	19	228	42
4494	13D	CTM 008	PU	19	215	136
4495	13D	CTM 010	PU	12	133	27
4496	13D	CTM 011	MI	19	216	90
4497	13D	CTM 012	MI	20	158	75
4498	13D	CTM 013	MI	24	91	28
4499	13D	CTM 014	MI	41	137	41
4500	13D	CTM 015	MI	16	140	56
4501	13D	CTM 016	MI	21	80	8
4502	12E	CTM 019	PU	32	156	120
4503	12E	CTM 020	PU	20	136	65
4504	12E	CTM 021	PU	19	117	78
4505	12E	CTM 022	PU	24	122	58
4506	12E	CTM 023	PU	23	218	83
4507	12E	CTM 024	PU	25	341	93
4508	12E	CTM 025	PU	24	271	94
4509	12E	CTM 026	PU	13	458	126
4510	12E	CTM 027	PU	23	322	97
4511	12E	CTM 028	PU	19	270	83
4512	12E	CTM 029	PU	47	164	53
4513	12E	CTM 030	PU	14	80	38
4514	12E	CTM 031	PU	9	71	23
4515	12E	CTM 032	PU	9	74	22
4516	12E	CTM 033	PU	18	85	17
4517	12E	CTM 034	MI	7	71	12
4518	12E	CTM 035	PU	15	67	28
4519	12E	CTM 036	PU	24	84	27
4520	12E	CTM 037	PU	8	40	19
4521	12E	CTM 038	PU	16	129	50
4522	12E	CTM 039	MI	7	63	17
4523	12E	CTM 040	MI	10	103	24

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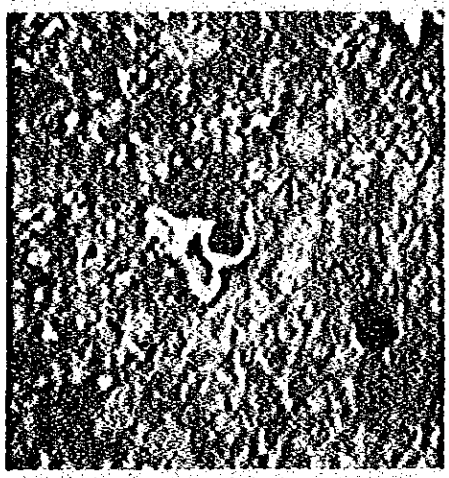
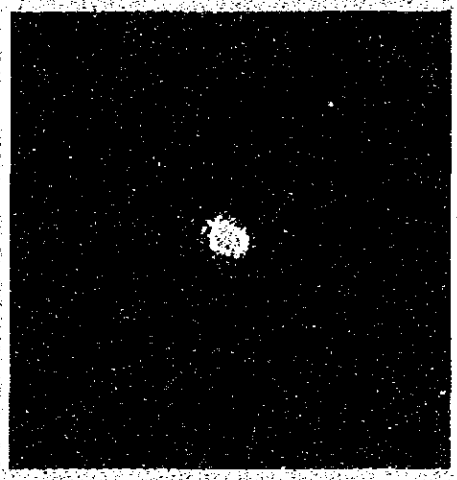
Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Zn (ppm)	Ni (ppm)
4524	5F	CTI 096	PU	100	333	126
4525	5F	CTI 097	PU	26	284	70
4526	5F	CTI 098	PU	31	322	109
4527	5F	CTI 099	PU	39	245	50
4528	5F	CTI 100	PU	18	333	73
4529	5F	CTI 101	PU	40	395	120
4530	5F	CTI 102	PU	38	408	124
4531	5F	CTI 103	PU	15	298	59
4532	5F	CTI 104	PU	21	253	79
4533	5F	CTI 105	PU	37	540	102
4534	5F	CTI 106	PU	23	391	105
4535	4F	CTL 132	MI	54	125	24
4536	4F	CTL 133	MD	34	65	9
4537	4F	CTL 134	MD	19	114	6
4538	4F	CTL 135	MD	22	119	18
4539	4F	CTL 136	MD	42	127	18
4540	4F	CTL 137	MD	43	116	9
4541	4F	CTL 138	MD	59	150	10
4542	4F	CTL 139	MD	109	181	15
4543	4F	CTL 140	MI	58	155	22
4544	4F	CTL 141	MI	23	250	30
4545	4F	CTL 142	MI	2	113	17
4546	5E	CTP 139	MI	2	70	10
4547	4E	CTP 140	MI	9	21	8
4548	4E	CTP 141	MI	82	284	10
4549	4E	CTP 142	MI	8	42	8
4550	4E	CTP 143	MI	45	64	14
4551	4E	CTP 144	MI	1	53	7
4552	4E	CTP 145	MI	8	29	13
4553	5E	CTP 146	PU	18	613	18
4554	5E	CTP 147	PU	3	226	12
4555	5F	CTP 148	PU	12	1,165	44
4556	5F	CTP 149	PU	12	732	25
4557	5F	CTP 150	PU	38	397	90
4558	5F	CTP 151	PU	27	300	114
4559	5F	CTP 152	PU	29	329	156

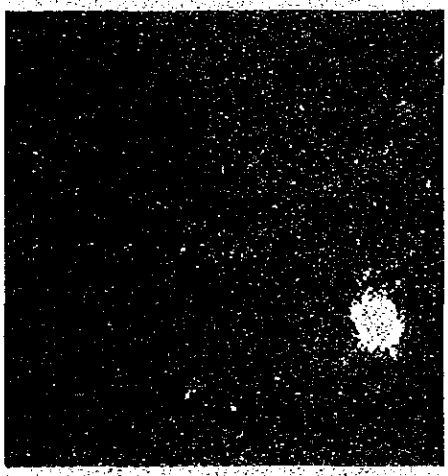
Sample No.	Location	Field No.	Geological Index	Cu (ppm)	Zn (ppm)	Ni (ppm)



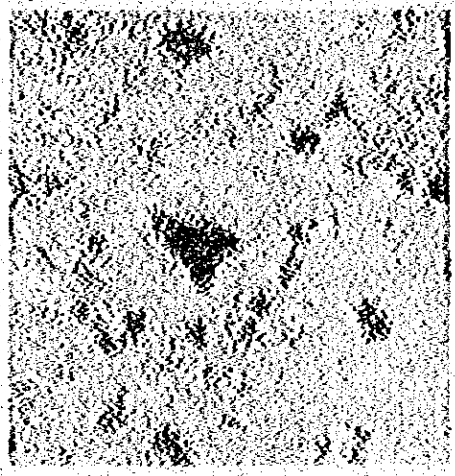
Absorbed electron image



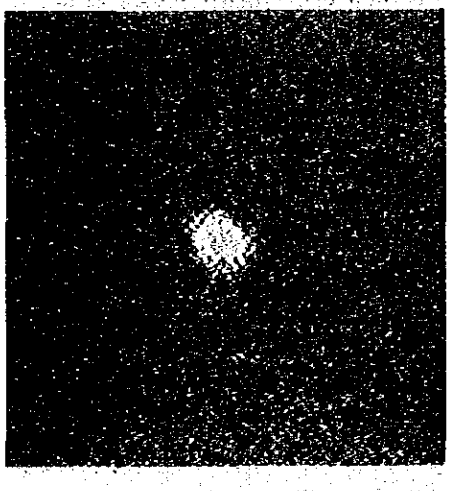
Zn X-ray image



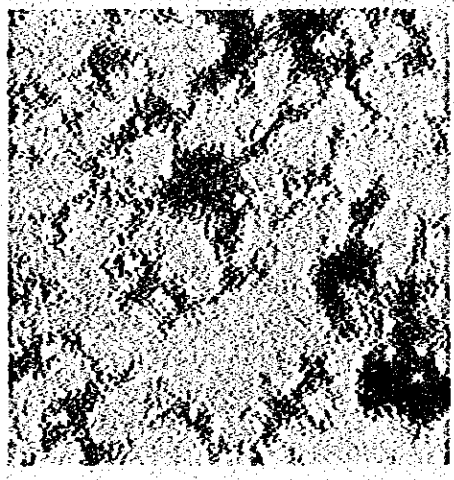
Fe X-ray image



Ca X-ray image



S X-ray image



Si X-ray image

Sample No. 610 (LI-022)
Accelerating voltage : 25 KV
Absorbed electron current : 0.2 μA
Magnification : x 1200

A. I · 14. Result of X-ray microanalysis