

**Appendix 2 Photomicrographs and microscopic  
observations of thin sections**

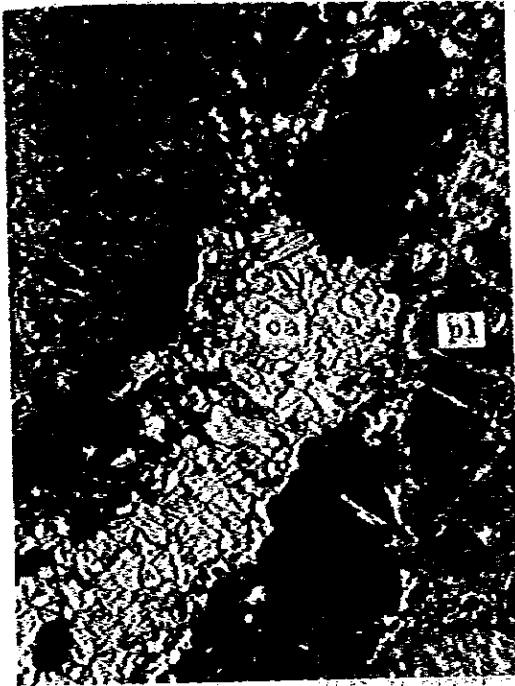
### Abbreviations

olivine	ol
plagioclase	pl
hematite	hm
hornblende	hb
sericite	ser
chlorite	chl
quartz	q
sulphide mineral	sm
calcite	ca
opacite	op
chalcopyrite	cp
epidote	ep
augite	ag
amygdale	am
sphalerite	sph
pyrite	py
rutile	rt
clay mineral	cm
sand stone block	ssb
shale block	shb

DO 021201 Olivine basalt-basic andesite (Venus Mine, Lo Prado Formation).

17-4 Open nicol.

17-5 Crossed nicols.



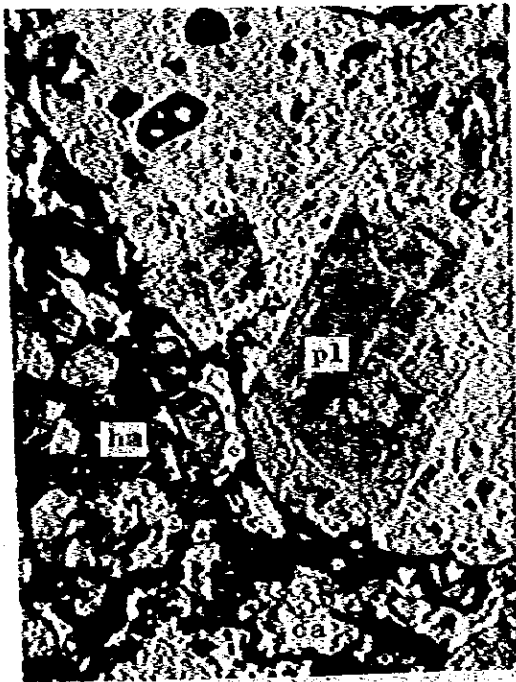
Veins of carbonates and sulfides with some amount of chlorite cut through the holocrystalline intergranular groundmass together with phenocrysts of plagioclase and olivine which is mostly carbonatized.

0.5mm

DO 020202 Volcanic conglomerate of opacitized andesite (Venus Mine, Lo Prado Formation)

17-6 Open nicol.

17-7 Crossed nicols.



Many fine grained crystals of hematite occur in the groundmass with phenocrysts of opacitized hornblende and plagioclase.

0.5mm

DO 020301 Oxydized and carbonatized andesite. (Las Chilcas Formation)

17-8 Open nicol.



17-9 Crossed nicols.



Intergrowths of plagioclase and opacified mafic minerals occur in the groundmass of hyalophilic groundmass with many hematite small crystals.

0.25mm

MI 0308 Altered andesite and dacite lapilli tuff (Prehuc member of Veta Negra Formation)

17-10 Open nicol.



17-11 Crossed nicols.

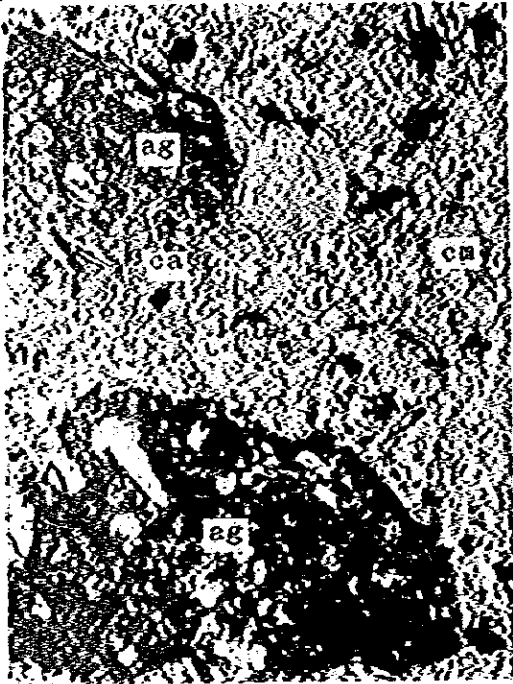


Both blocks and matrix are affected sericization and chloritization.

0.25mm

DO 020302 Altered coarse andesitic tuff (Las Chilcas Formation)

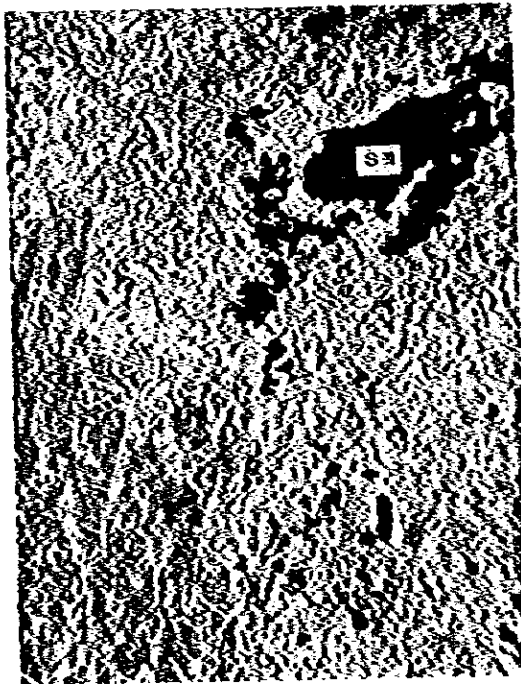
17-12 Open nicol.



Carbonate minerals and hematite occur throughout the matrix.

TA 0612 Trachytic dacite. (El Salado Mine, veta Negra Formation)

17-15 Open nicol.



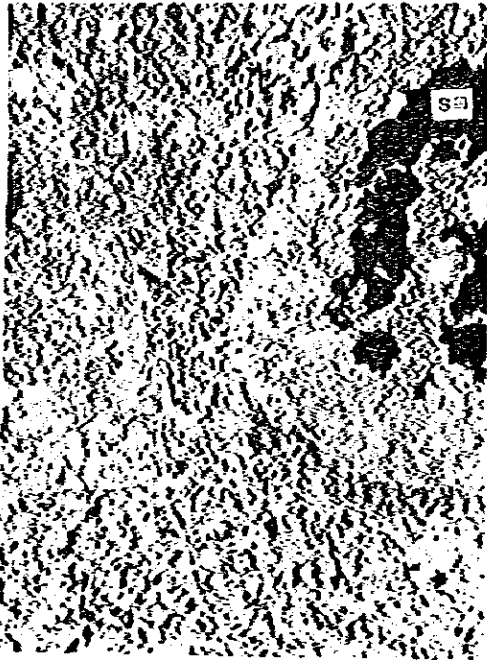
Amygdales being filled by quartz, carbonates and sulfides occur in the groundmass of holocrystalline feldspar lath with plagioclase phenocrysts.

17-16 Crossed nicols.

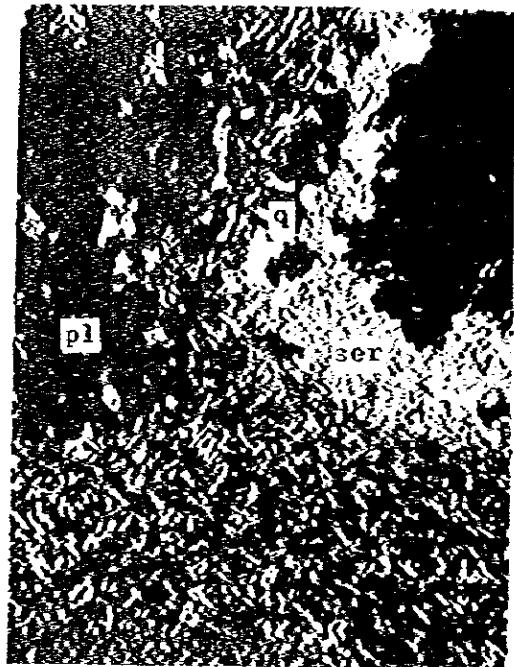


TA 0613 Altered Jacite. (El Salado Mine, Veta Negra Formation)

17-17 Open nicol.



17-18 Crossed nicols.

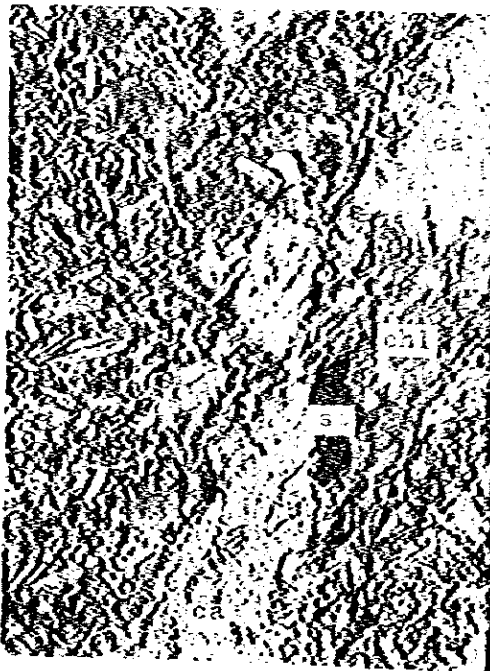


Amygdals being filled by quartz, sericite and sulfide minerals are abundant in the groundmass of holocrystalline feldspar lath.

0.5mm

DO 020605 Altered and carbonatized andesitic lapilli tuff. (Animas Mine, Cerro Morado Formation)

17-19 Open nicol.



17-20 Crossed nicols.

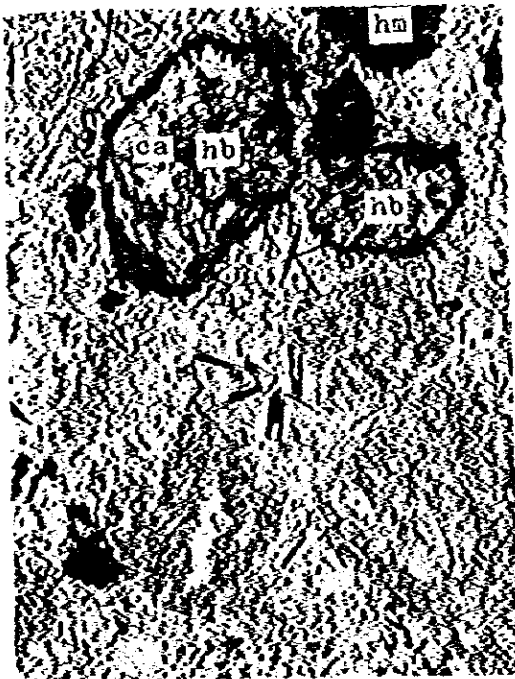


Carbonates with some sulfide minerals fill the veinlets and replace the rock mainly a part of matrix.

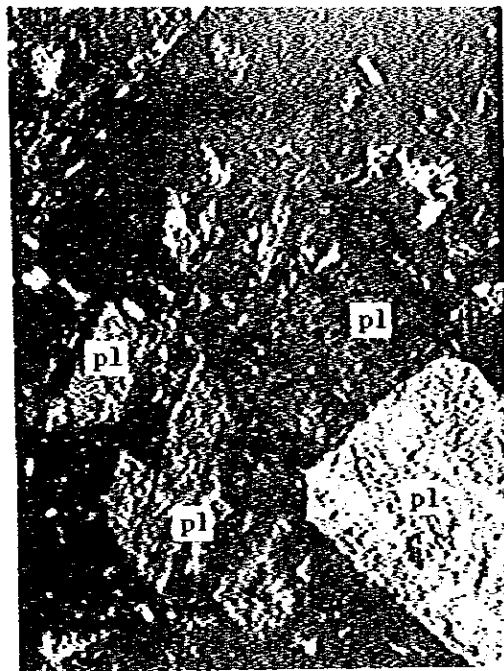
0.25mm

TA 0401 Altered opacite andesite. (Las Chilcas Formation)

17-21 Open nicol.



17-22 Crossed nicols.



Carbonates and epidote replace the opacite after hornblende.

0.25mm

DO 020206 Altered glassy andesite. (Lo Prado Formation)

17-23 Open nicol.



17-24 Crossed nicols.

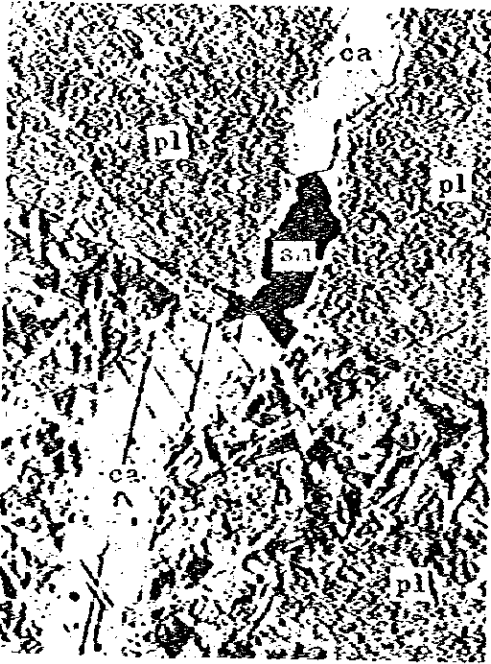


Glassy groundmass with distinct flowage has recrystallized keeping its original texture. Hornblende has altered to chlorite, and a part of plagioclase phenocrysts has altered to sericite.

0.25mm

IA 1203 Altered coarse grained dacite with chalcopyrite dissemination. (Venus Mine, Lo Prado Formation)

17-25 Open nicol.



17-26 Crossed nicols.



0.25mm

DO 020602 Augite andesite with calcite and chalcopyrite veinlet. (Animas Mine, Cerro Morado Formation)

17-27 Open nicol.



17-28 Crossed nicols.



0.25mm

Glass part of hyalophitic ground-mass has altered to clay minerals and carbonates.



DO 020312 Altered augite andesite. (Prehue member of Veta Negra Formation)

17-29 Open nicol.



17-30 Crossed nicols.

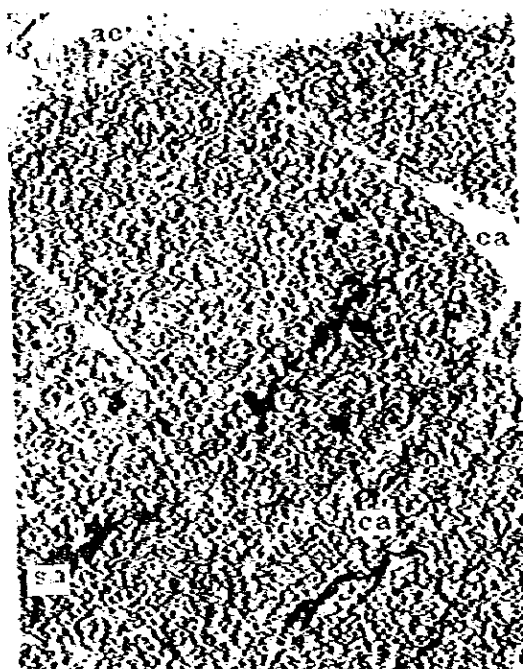


A part of plagioclase phenocrysts has altered to sericite. Phenocrysts of hornblende has altered to opacite and chlorite. Augite phenocrysts remain fresh.

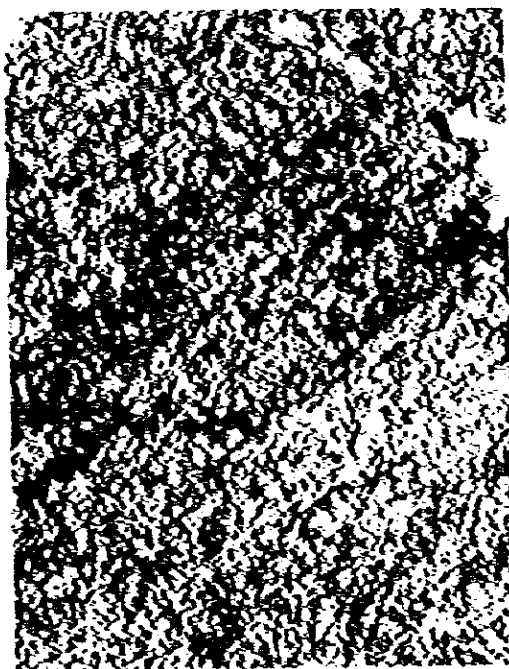
0.25mm

TA 0603 Fine grained impure limestone. (Animas Mine, Cerro Morado Formation)

17-31 Open nicol.



17-32 Crossed nicols.

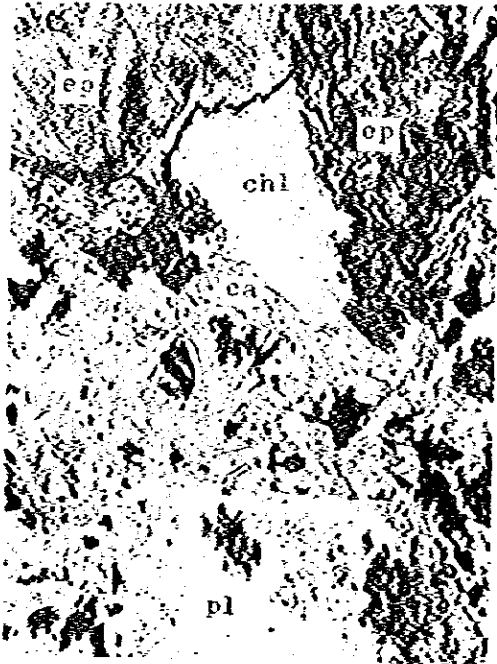


A thin layer of sulfide minerals occurs occasionally along the bedding plane. Calcite veinlets as segregation product cut casually.

0.25mm

TA 1201 Altered dacite. (Venus Mine, Lo Prado Formation)

17-33 Open nicol.



17-34 Crossed nicols.

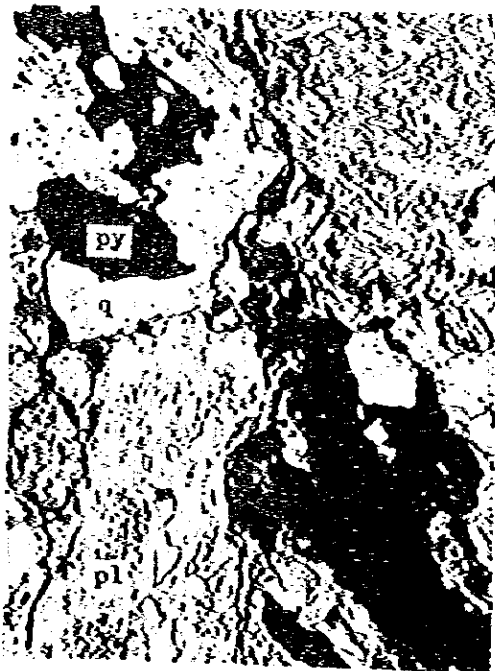


Epidote veinlet with calcite and quartz crossed heavily. Amygdalites are also filled by gangue minerals.

0.25mm

DO 020704 Altered olivine basalt lapilli tuff. (Guayacan Mine, Lo Prado Formation)

17-35 Open nicol.



17-36 Crossed nicols.

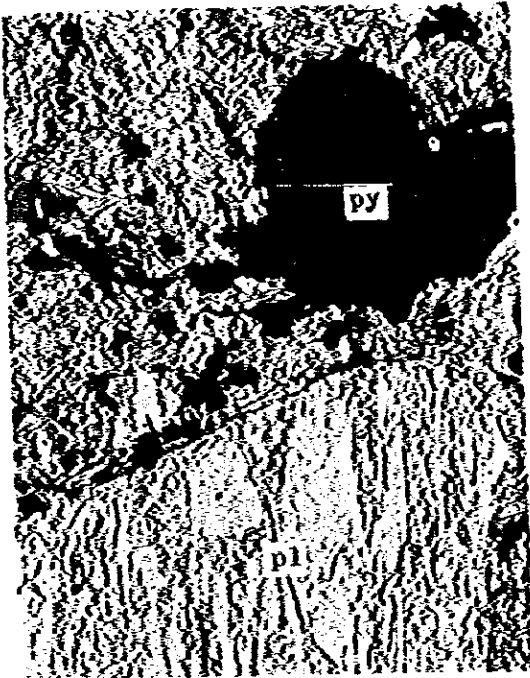


Carbonates replace the rock mainly at the matrix part.

0.25mm

TA 0704 Porphyritic altered dacite. (Guayacan Mine, Lo Prado Formation)

18-1 Open nicol.



18-2 Crossed nicols.

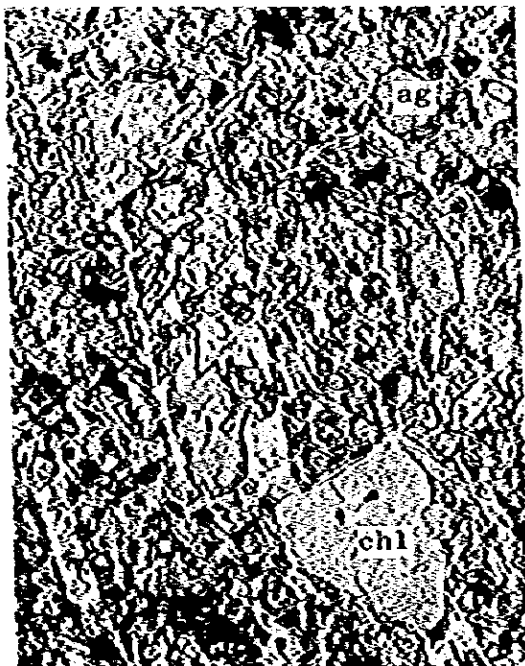


Sulfide minerals of chalcopyrite, sphalerite or pyrite replace a part of plagioclase phenocrysts and fill veinlets together with mainly calcite and quartz.

0.25mm

TA 0703 Porphyritic pyroxene olivine basalt. (Guayacan Mine, Lo Prado Formation)

18-3 Open nicol.



18-4 Crossed nicols.



Plagioclase phenocrysts of large size occur in the groundmass of intergranular texture together with phenocrysts of augite and pseudomorphs after olivine.

0.25mm

TA 1202 Coarse grained altered andesite. (Venus Mine, Lo Prado Formation)

18-5 Open nicol.



18-6 Crossed nicols.

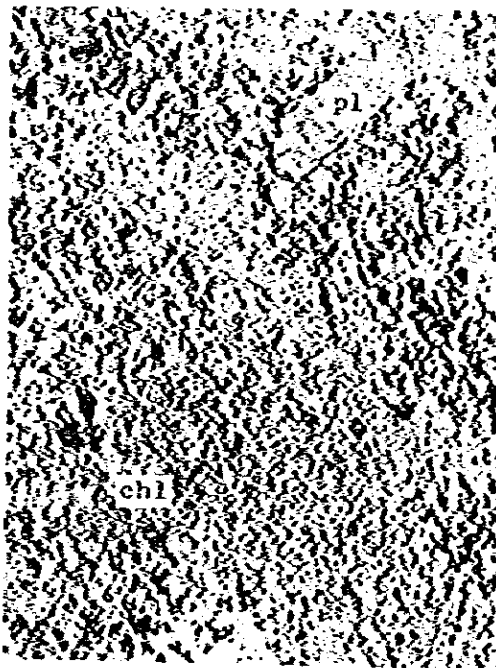


Plagioclase phenocrysts occur in the groundmass of intersertal texture. Veinlets of calcite, quartz and epidote cross around.

0.25mm

DO 020307 Altered agglomerate. (Lo Prado Formation)

18-7 Open nicol.



18-8 Crossed nicols.

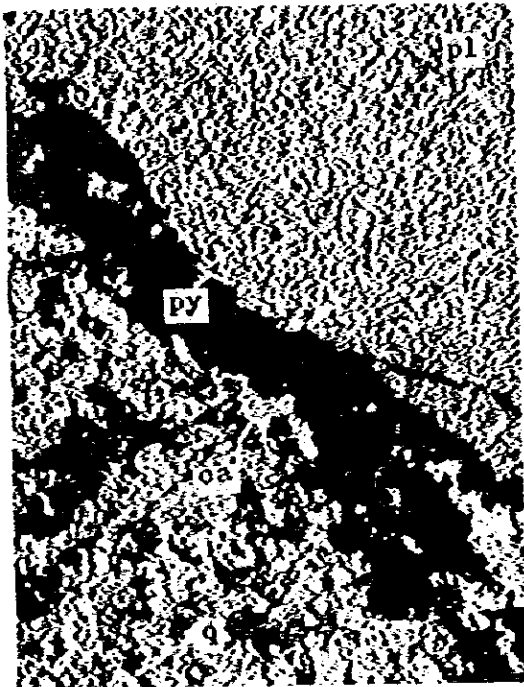


Blocks of fine grained ophitic olivine basalt are predominated. Matrix has been affected by sericitization and silicification.

0.25mm

DO 020801 A contact part of dacite and sandstone. (La Verde Mine, Lo Prado Formation)

18-9 Open nicol.



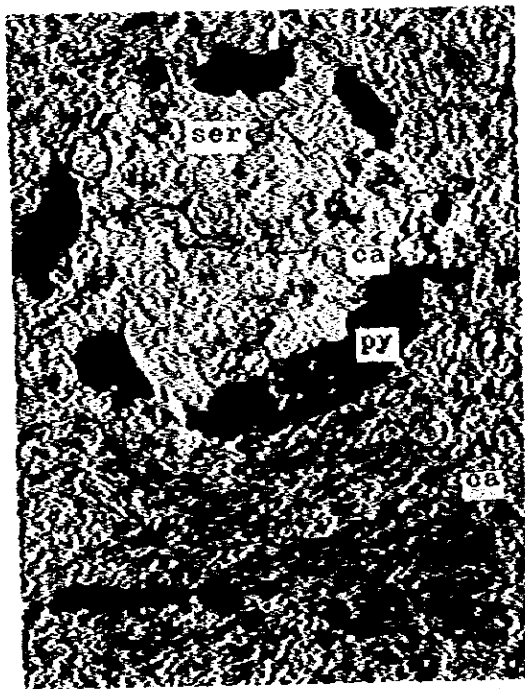
18-10 Crossed nicols.



0.25mm

DO 020801 Dacite. (La Verde Mine, Lo Prado Formation)

18-11 Open nicol.



18-12 Crossed nicols.

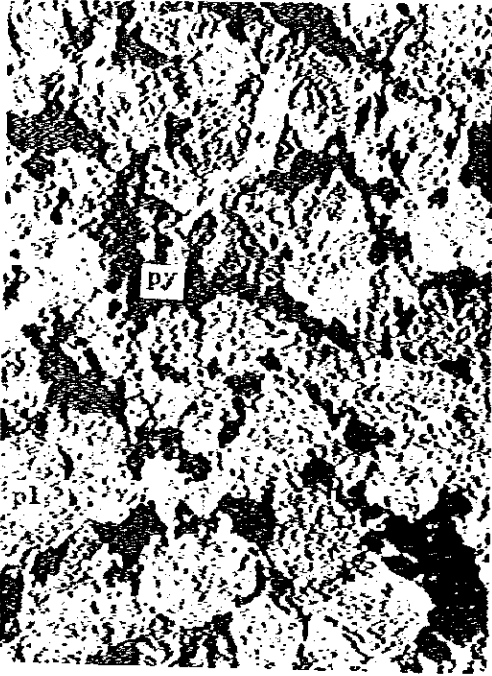


0.25mm

Flowage of the dacite is cut diagonally by the boundary indicating the dacite is a block. Amygdales are abundant in the dacite part being filled mostly by sericite, calcite, sulfide minerals and occasionally rutile. Sandstone has impregnation of sulfides and carbonates along its cleavage plane.

DO 020801 Sandstone. (La verde Mine, Lo Prado Formation)

18-13 Open nicol.



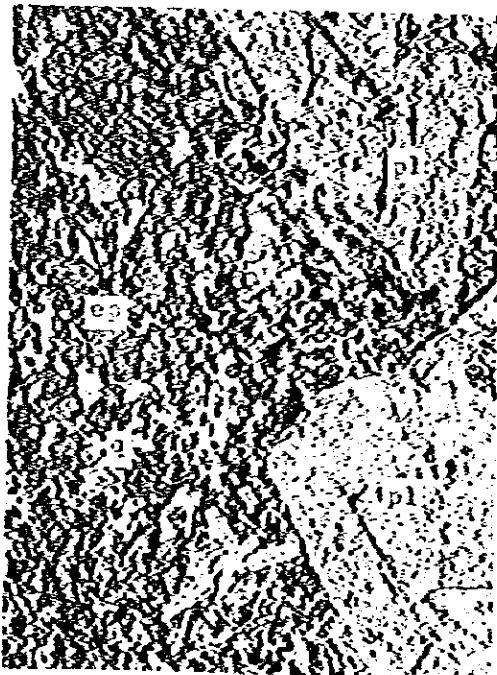
18-14 Crossed nicols.



0.25mm

MI 0301 Porphyritic basic andesite (so called "Ocoite", Ocoa member of Veta Negra Formation)

18-15 Open nicol.



18-16 Crossed nicols.



0.5mm

Plagioclase phenocrysts of large sizes occur abundantly in the groundmass of ophitic texture. Epidote, quartz and calcite are filling the veinlets as well as replacing a part of the rock.

DO 021302 Banded limestone. (Fortuna Mine, Las Chilcas Formation)

18-17 Open nicol.



18-18 Crossed nicols.

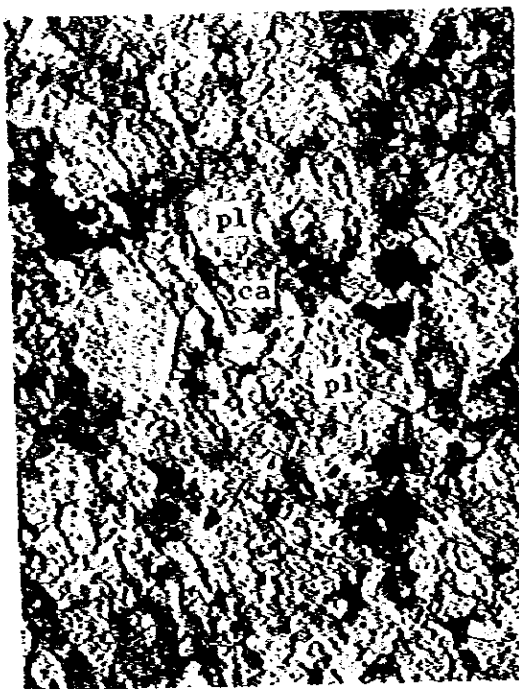


It contains small amounts of sand and clay materials.

0.25mm

DO 020703 Graywacke sandstone (Guayacan Mine, Lo Prado Formation)

18-19 Open nicol.



18-20 Crossed nicols.



Grains of detrital quartz and feldspars as well as materials of clays are predominant. Carbonate mineral replaces partly throughout the matrix.

0.25mm



TA 0610 Altered fine grained porphyritic andesite. (El Salado Mine, Veta Negra Formation)

18-21 Open nicol.



18-22 Crossed nicols.



Magioclase phenocrysts of large size occur abundantly in the fine grained groundmass of hyaloplitic texture.

0.25mm

IX 021202 Porphyritic dacite (Venus Mine, Lo Prado Formation)

18-23 Open nicol.



18-24 Crossed nicols.



0.5mm



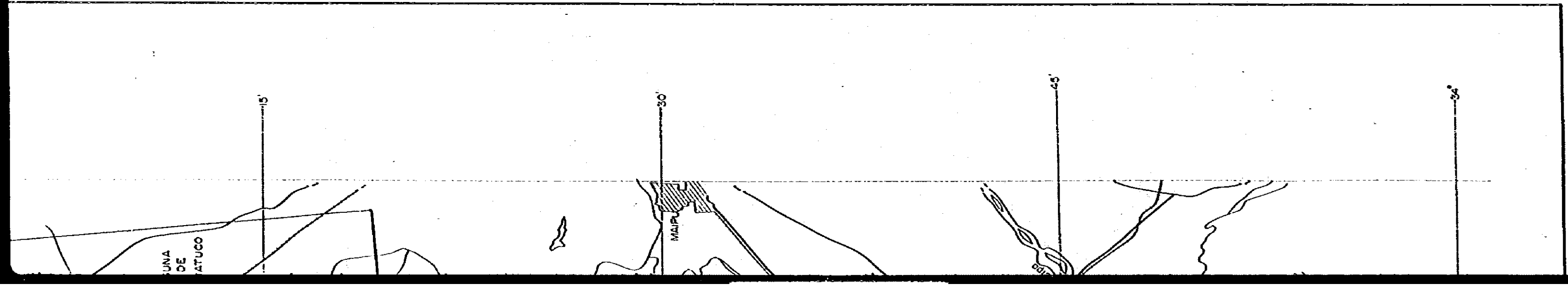




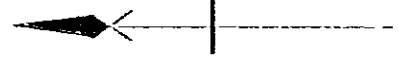
67	MANTO BRON	68	DABÚ	69	BRONCEADA	70	LA LIBERTAD	71	CARMELITITA
72	NEGRITA	73	FUENTES	74	LAS GUIAS (NALTAGUA)	75	BRILLANTE	76	EL GATO
77	LA MECHICERA								

① ----- not investigated

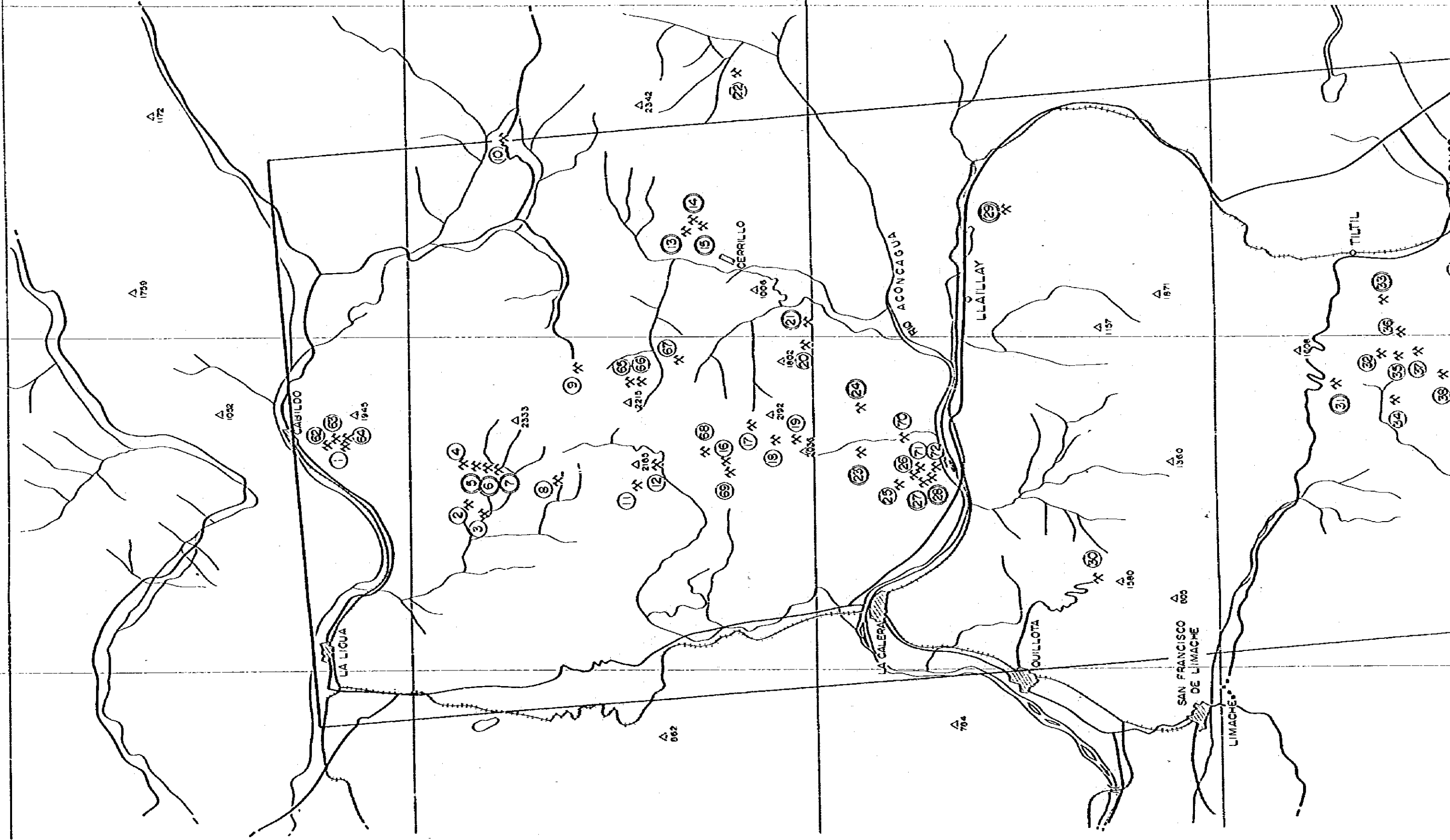
⑤ ----- Investigated in 1980 (CHILEAN - JAPANESE MISSION)



7°15' 7°00' 7°45'



30° 45° 33°



SEALPAICO

TILTIL

LLAILLAY

ACONCAHUJA

CERRILLO

CABILDO

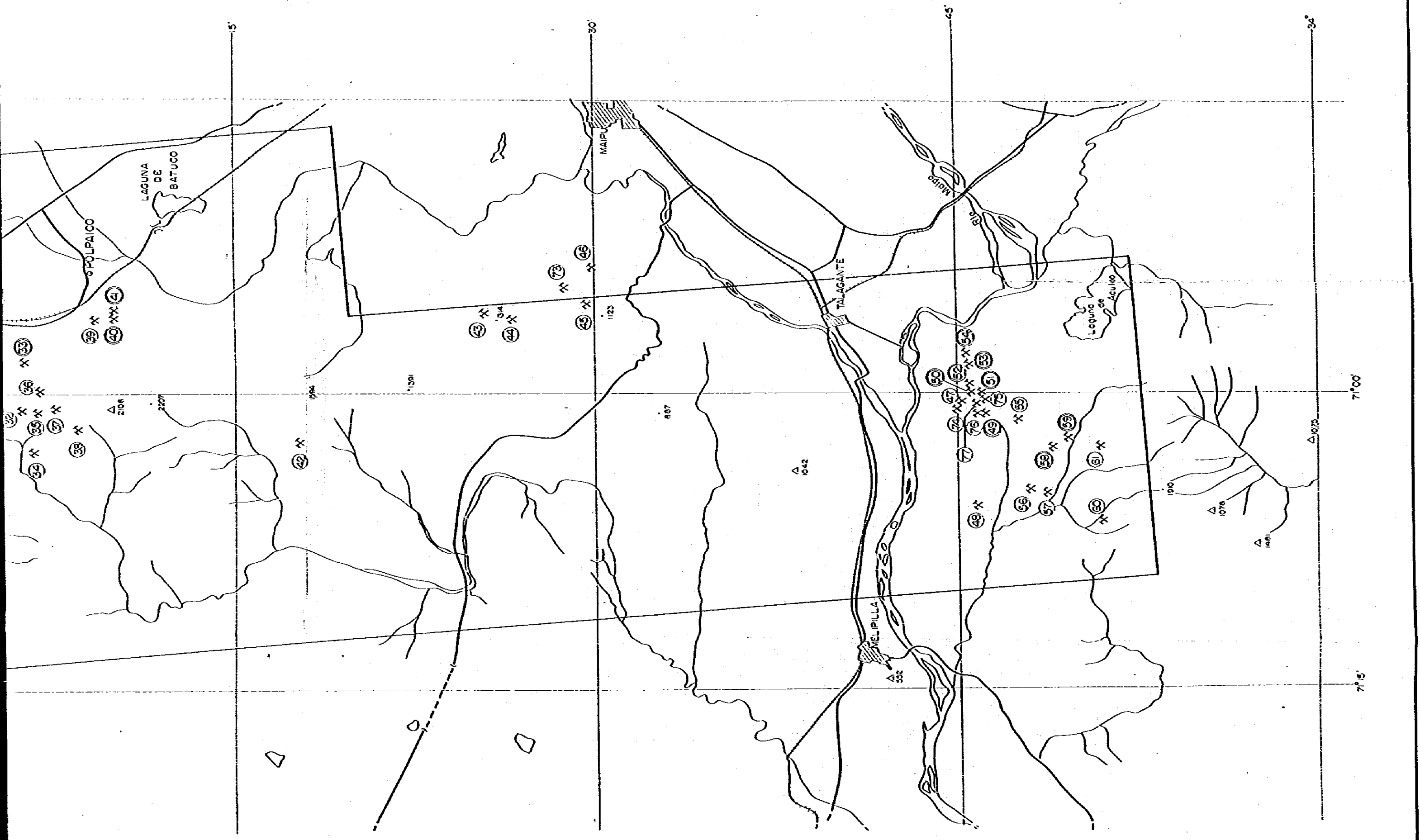
LA LIQUA

LA CALERA

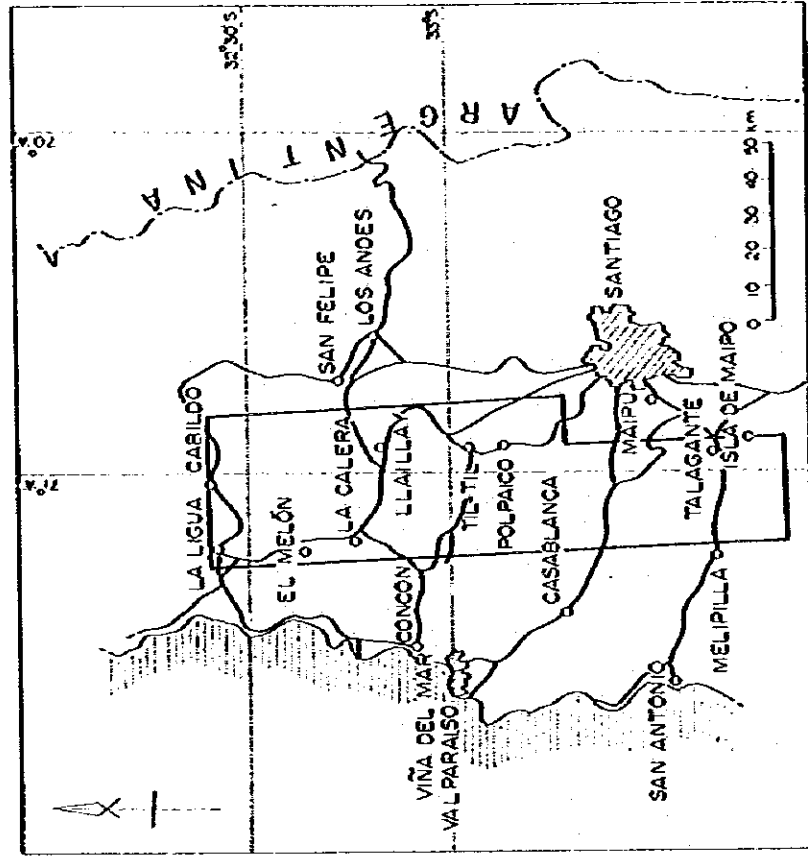
QUILLOTA

SAN FRANCISCO DE LIMACHE

LIMACHE



MINERAL RESOURCES DEVELOPMENT  
IN  
THE REPUBLIC OF CHILE  
GEOLOGICAL MAP  
OF  
THE INVESTIGATED AREA



JAPAN INTERNATIONAL COOPERATION AGENCY  
GOVERNMENT OF JAPAN

MARCH 1980

prepared by DOWA ENGINEERING CO., LTD.

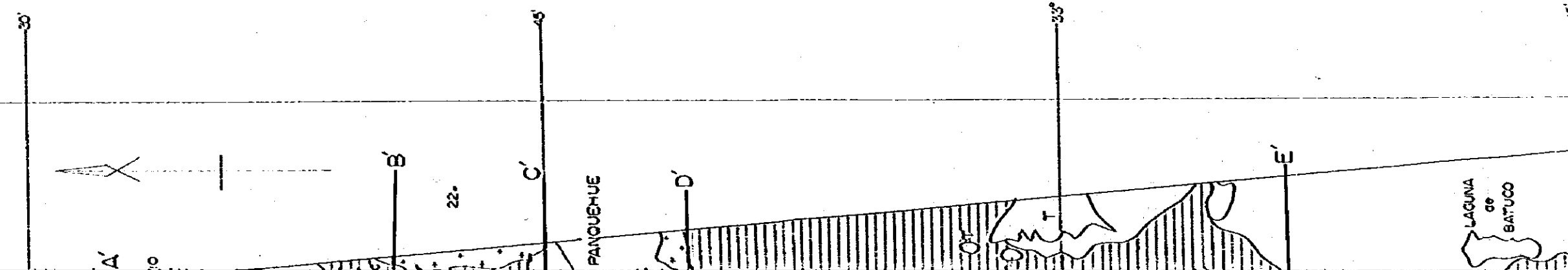
SCALE 1 : 250,000



LEGEND

[Blank box]	QUATERNARY
[Box with 'T']	TERTIARY
[Box with horizontal lines and 'Kic']	LAS CHILCAS FOR.
[Box with vertical lines and 'Kcm']	CERRO MORADO FOR.
[Box with diagonal lines and 'Kyn']	VETA NEGRA FOR.
[Box with diagonal lines and 'Kip']	LO PRADO FOR.
[Box with 'Jm']	MELÓN FOR.
[Box with 'Jo']	AVIAL FOR.
[Box with 'Jcp']	QUEBRADA EL POBRE FOR.
[Box with 'Tr']	TRIASSIC

} CRETACEOUS  
} JURASSIC



QUATERNARY

TERTIARY

LAS CHILCAS FOR.

CERRO MORADO FOR.

VETA NEGRA FOR.

LO PRADO FOR.

MELÓN FOR.

AJIAL FOR.

QUEBRADA EL POBRE FOR.

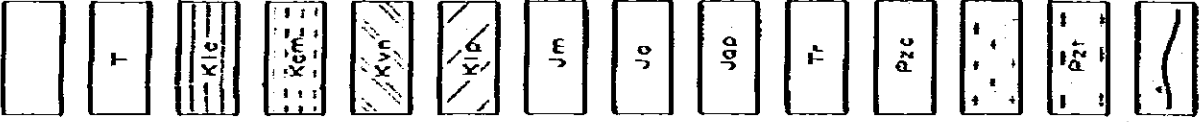
TRIASSIC

PALEOZOIC

CENTRAL BATHOLITH [GRANODIORITE etc.]  
(CRETACEOUS ~ TERTIARY?)

COAST BATHOLITH [TONALITE, ADAMELITE etc.]  
(PALEOZOIC)

FAULT



CRETACEOUS

JURASSIC

E

LAGUNA  
de  
BATUCO

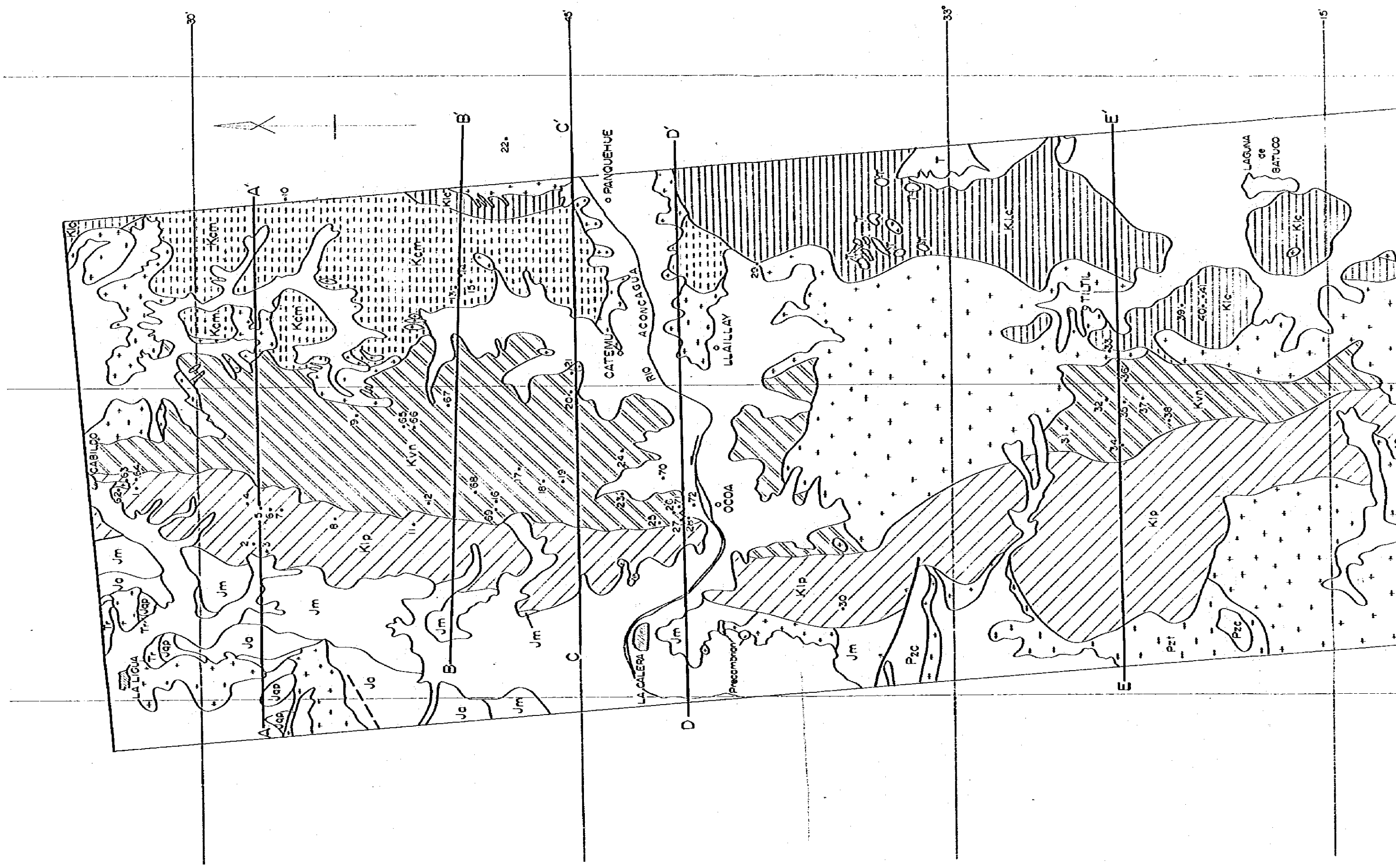
15

E

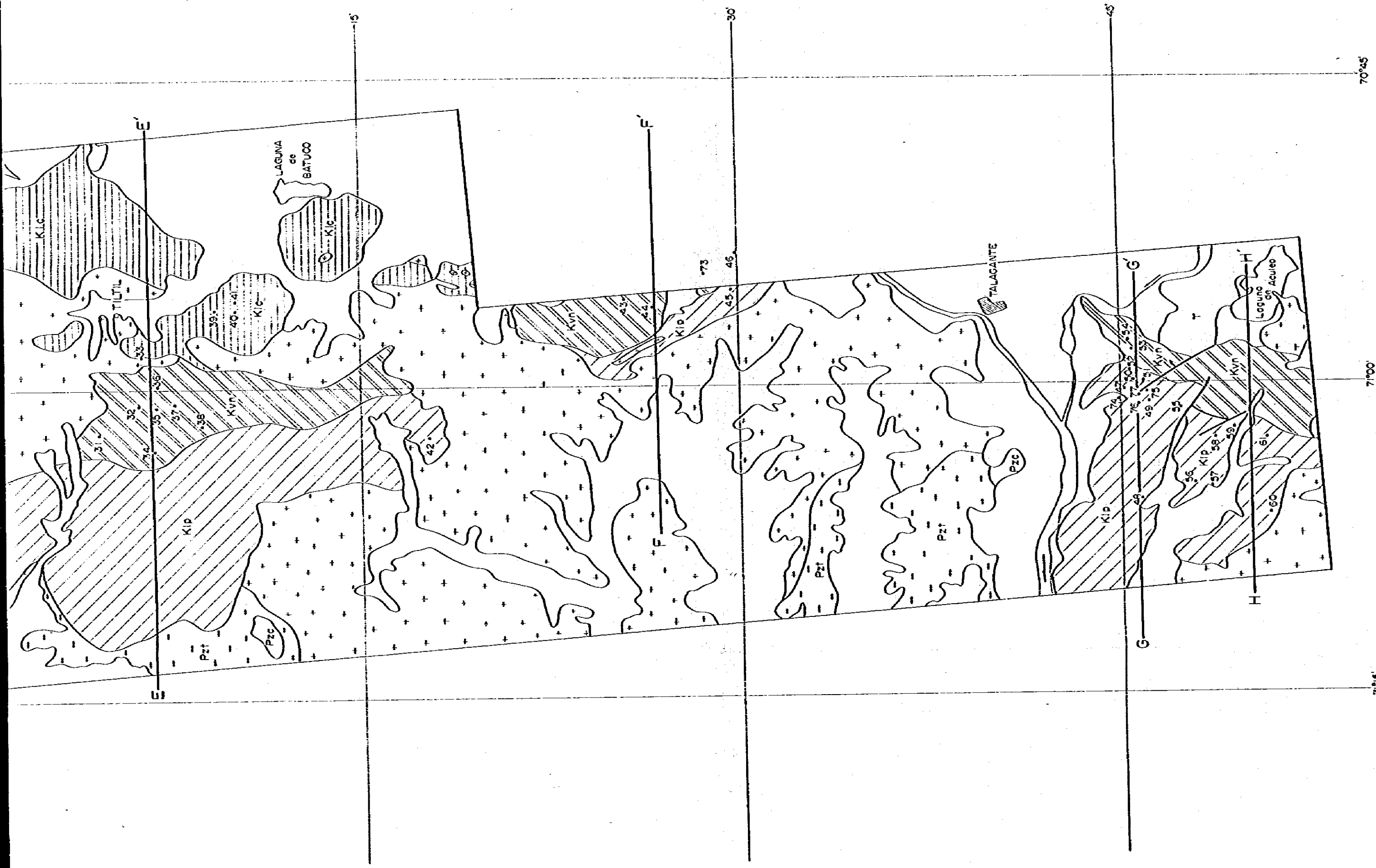
30

45

70°45'



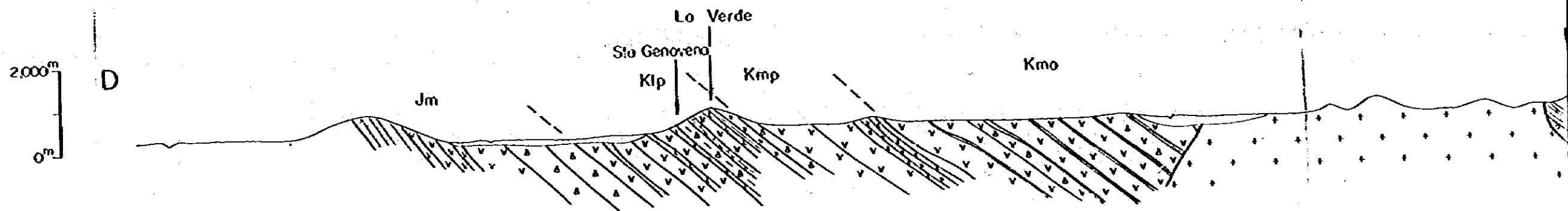
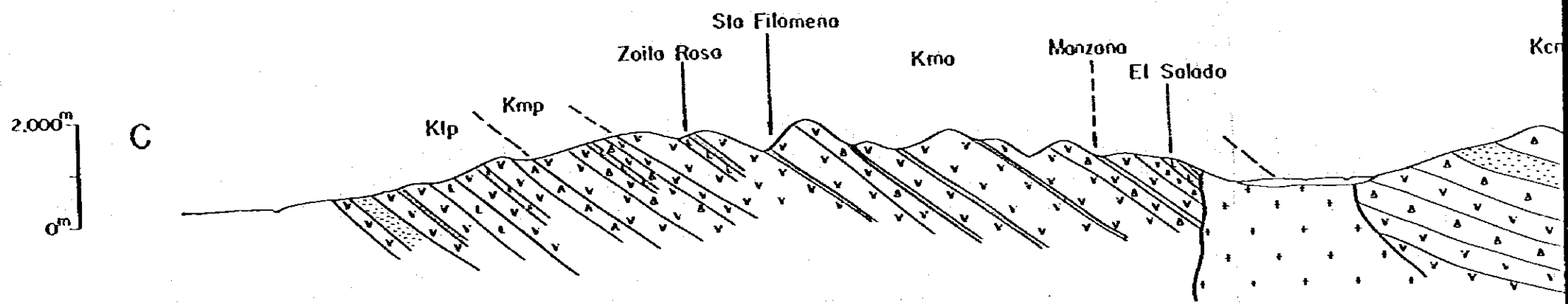
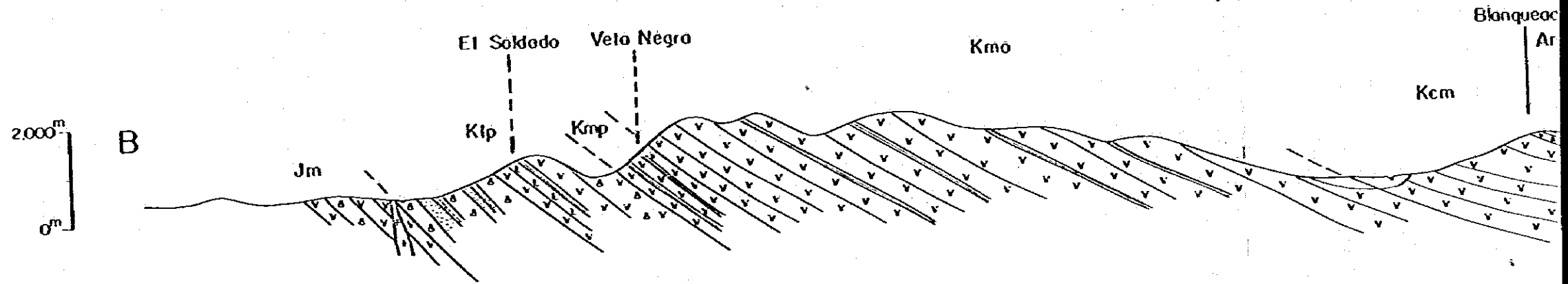
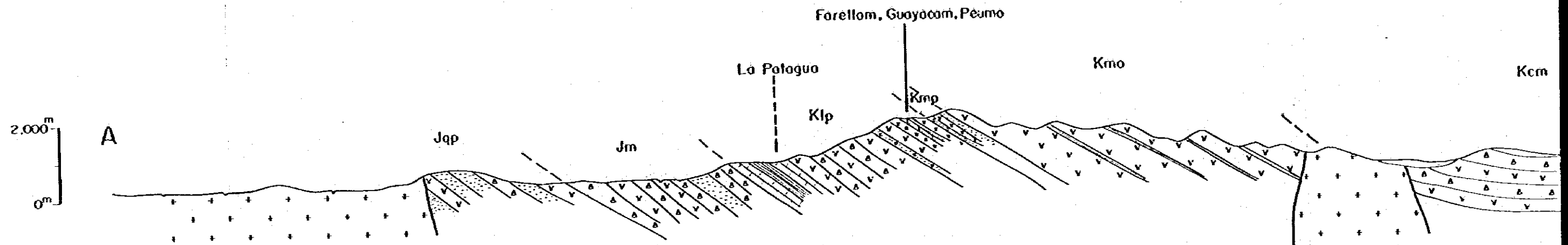




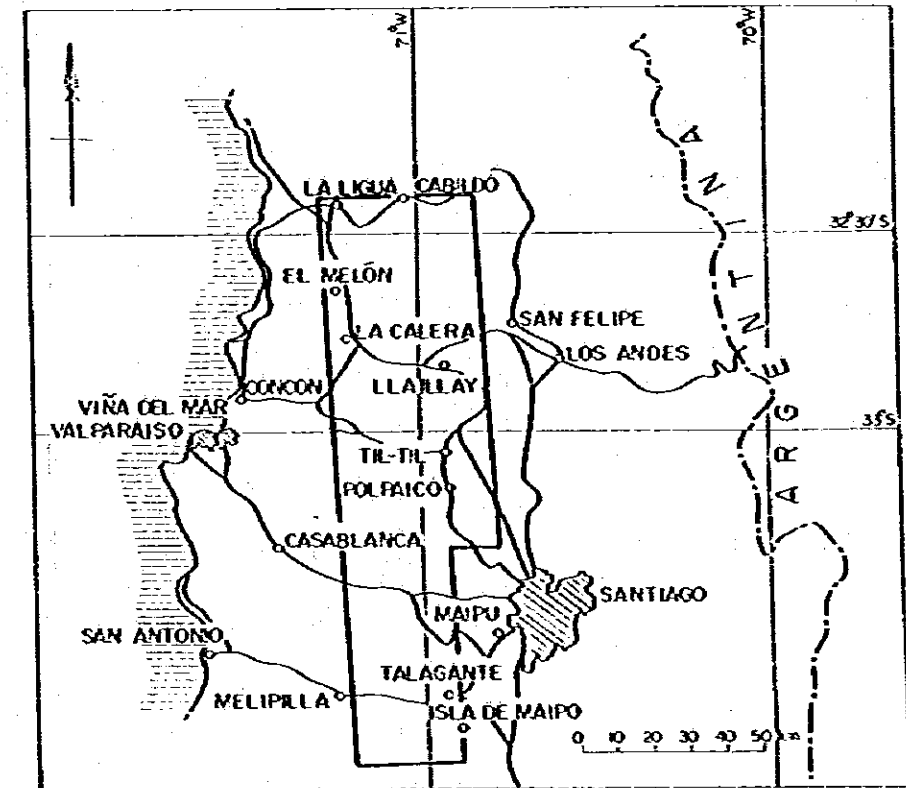
70°45

71°00

71°15



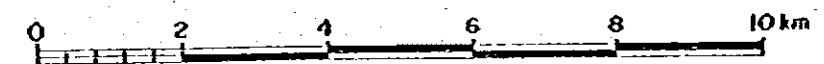
MINERAL RESOURCES DEVELOPMENT  
IN  
THE REPUBLIC OF CHILE  
GEOLOGICAL PROFILE  
OF  
INVESTIGATED AREA



JAPAN INTERNATIONAL COOPERATION AGENCY  
GOVERNMENT OF JAPAN

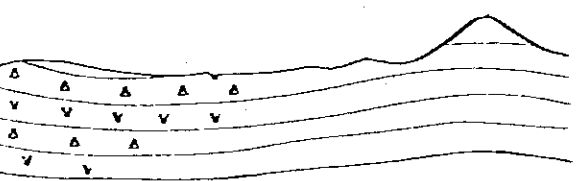
MARCH 1980  
prepared by DOWA ENGINEERING CO., LTD.

SCALE 1 : 100,000



Kcm

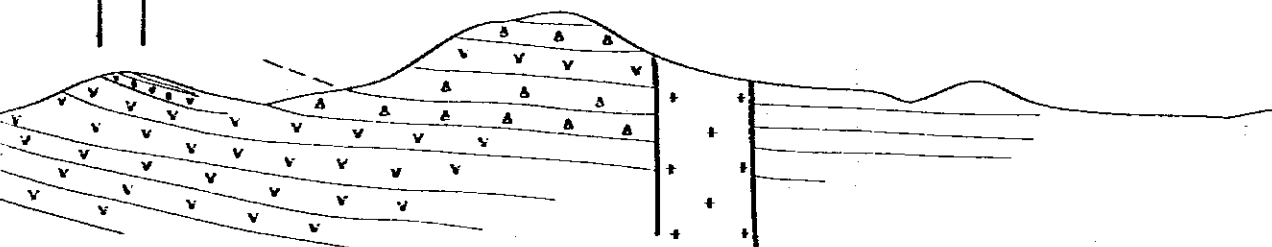
A'



Blanqueado  
Animas, Romero

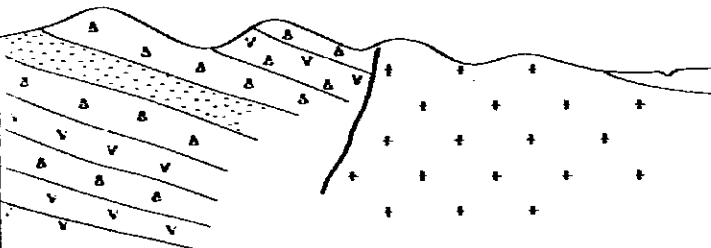
Klc

B'



Kcm

C'

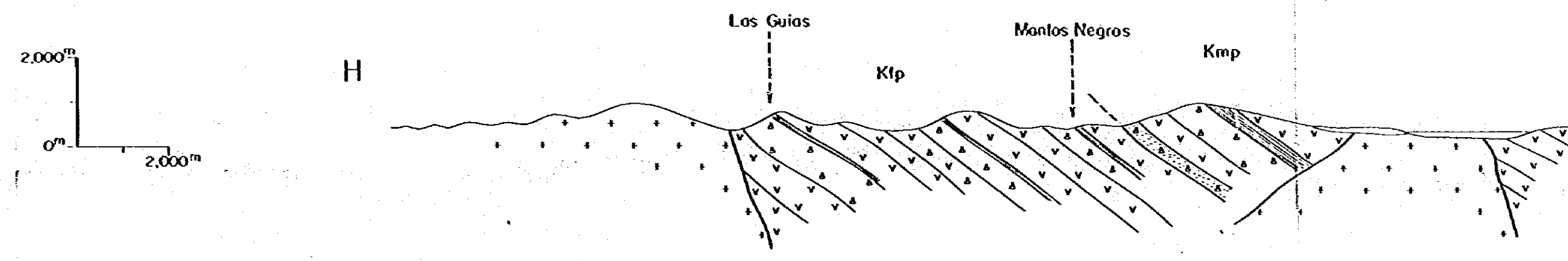
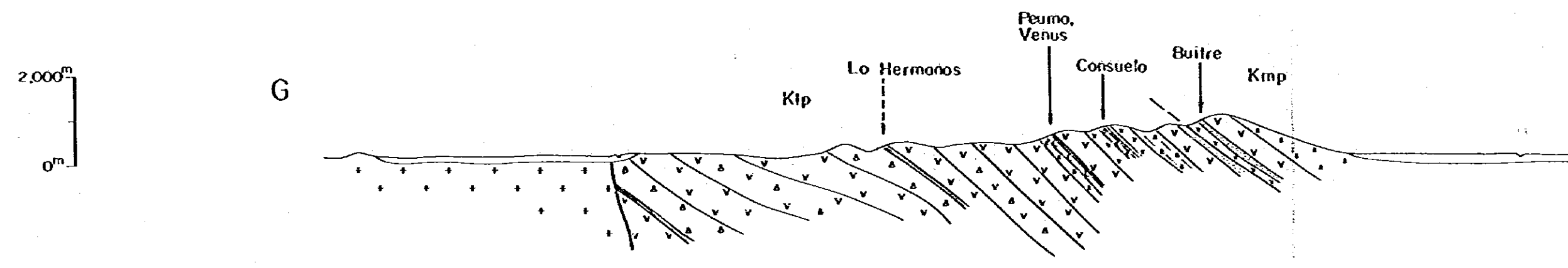
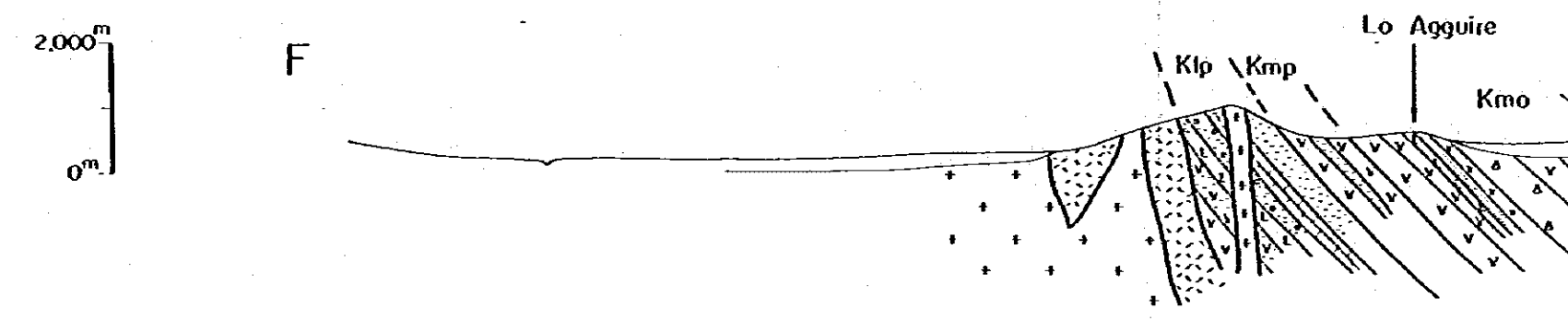
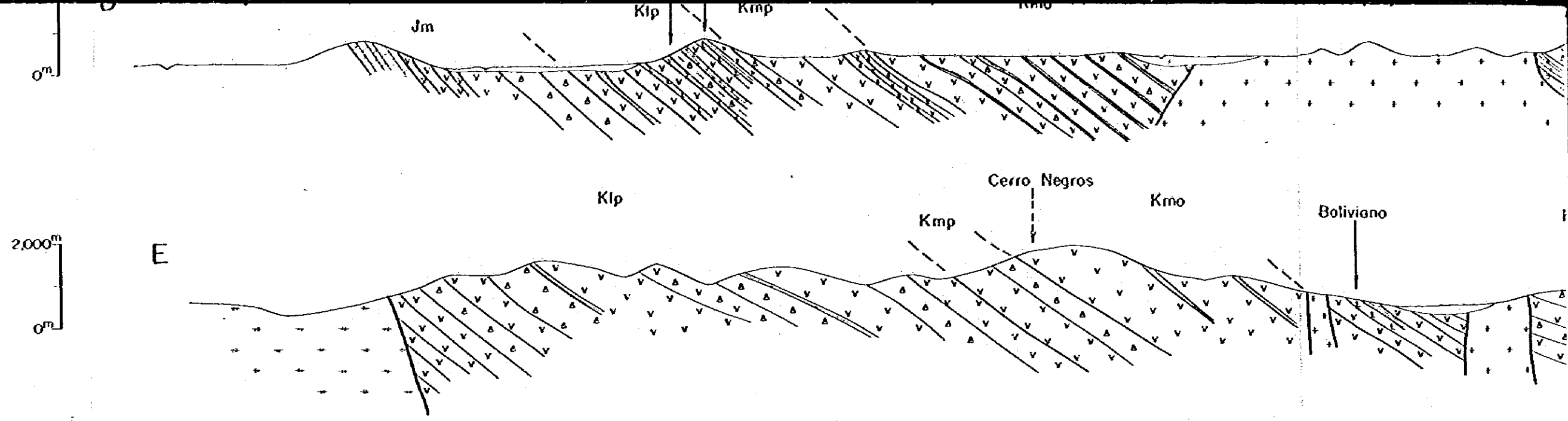


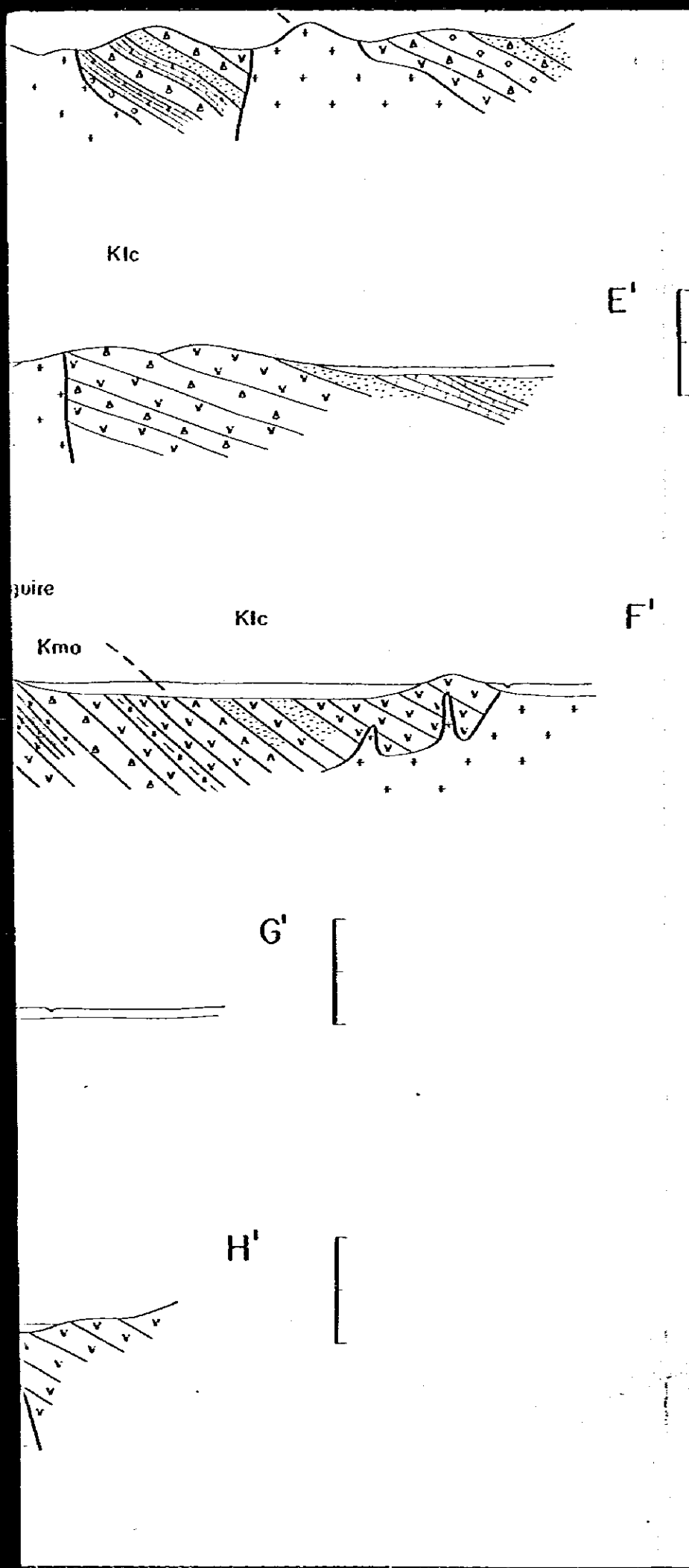
Kcm

Klc















D'







### LEGEND

-  Shale
-  Sandstone
-  Conglomerate
-  Limestone
-  Tuff
-  Volcanic breccia
-  Ignimbrite
-  Dacitic rock
-  Andesite
-  Autobrecciated andesite
-  Trachite
-  Granodiorite etc.
-  Tonalite etc.
-  Marginal facies of intrusive rocks

社会開発協力部報告書



ARY