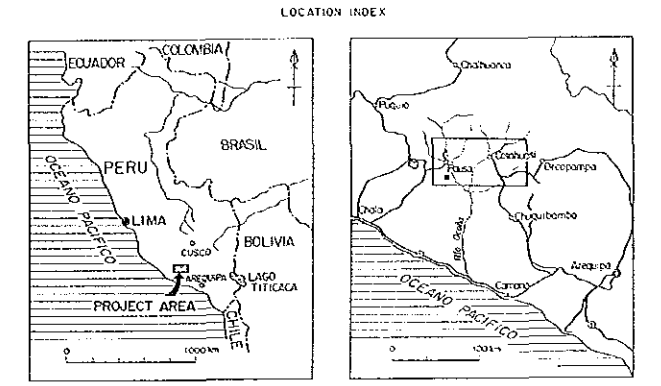
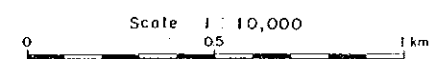


MINERAL EXPLORATION
IN
COTAHUASI AREA
(PHASE II)

GEOLOGICAL MAP
OF THE PIRCA EASTERN AREA

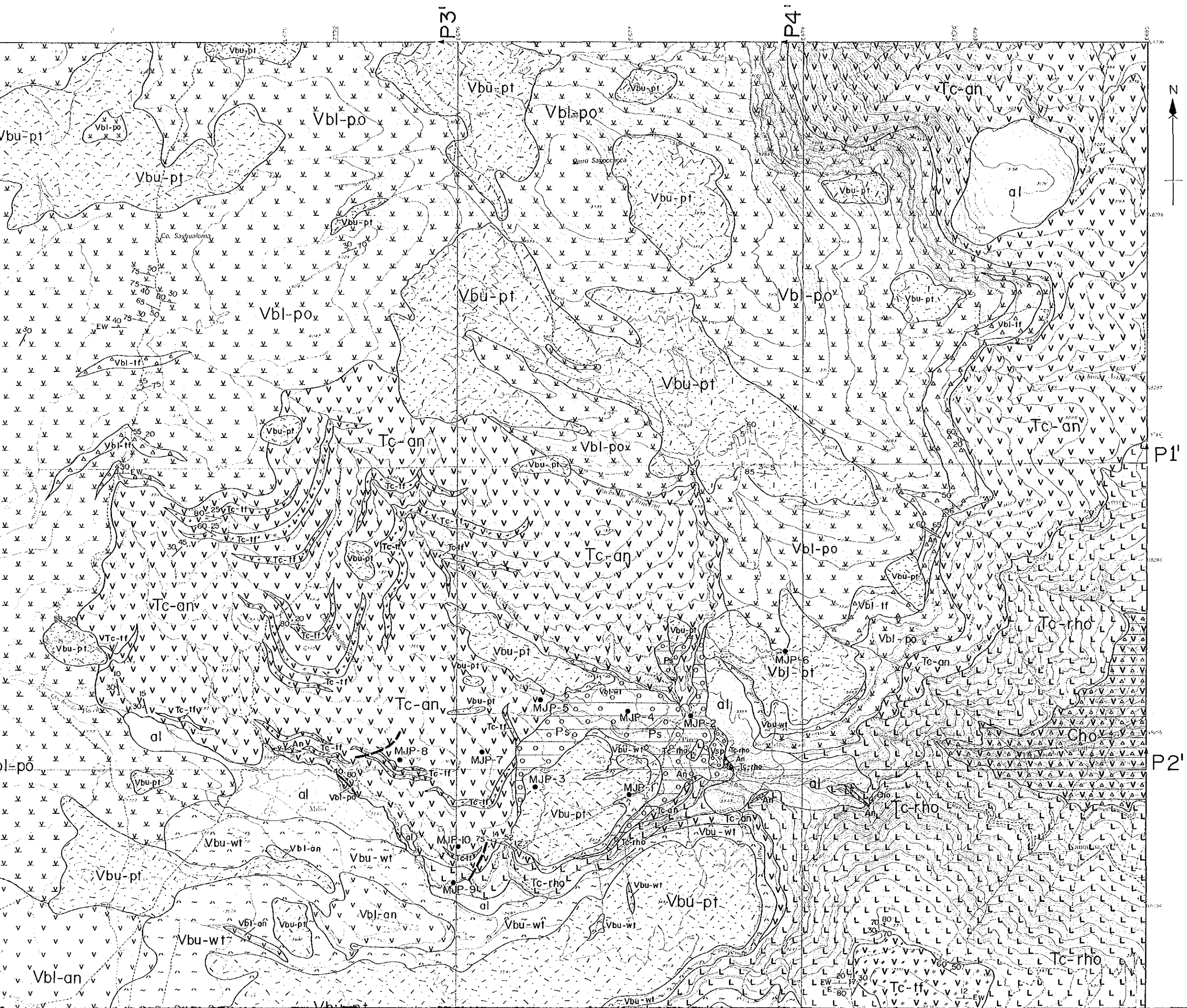


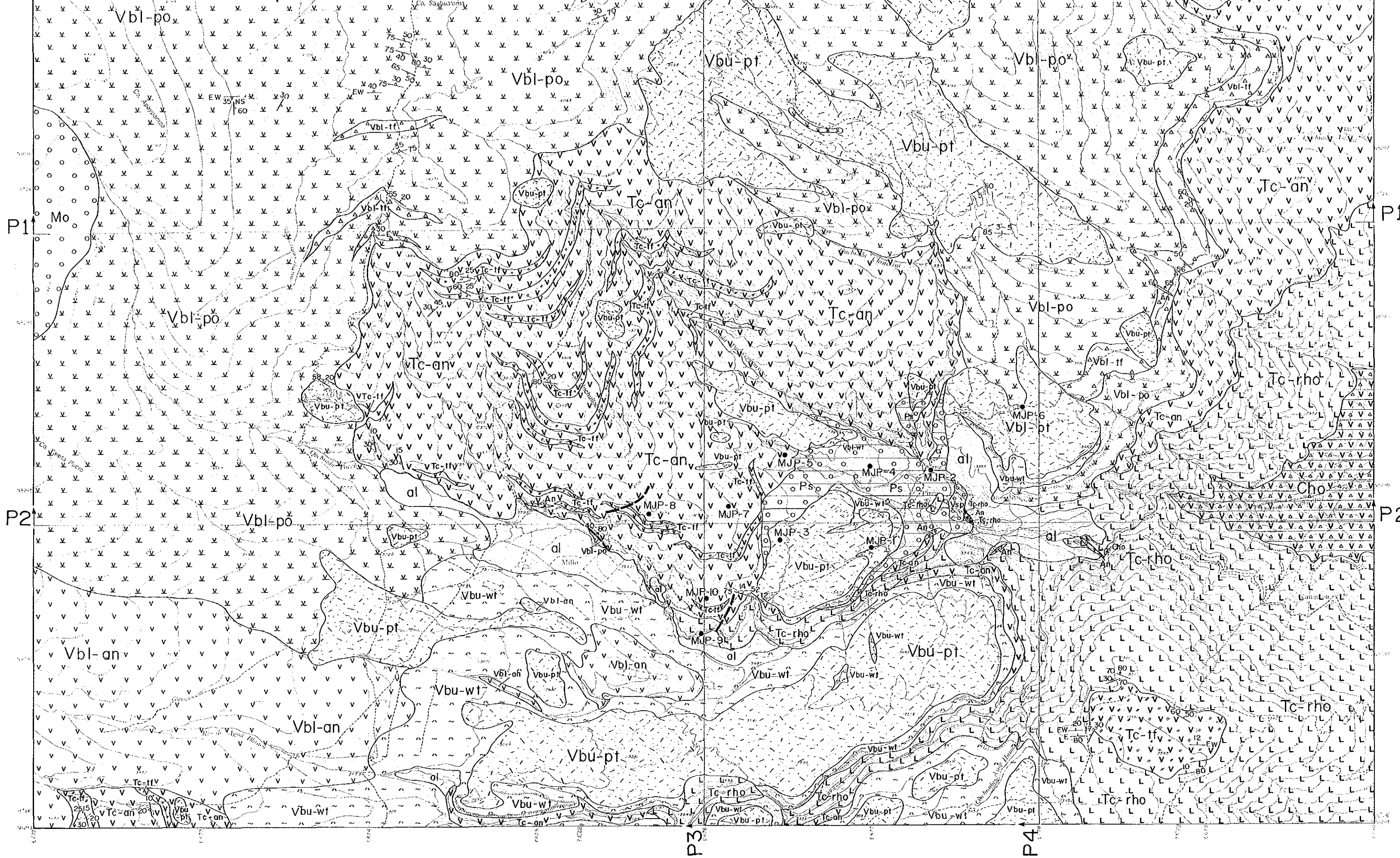
JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN
INSTITUTO GEOLOGICO MINERO Y METALURGICO
February 1987

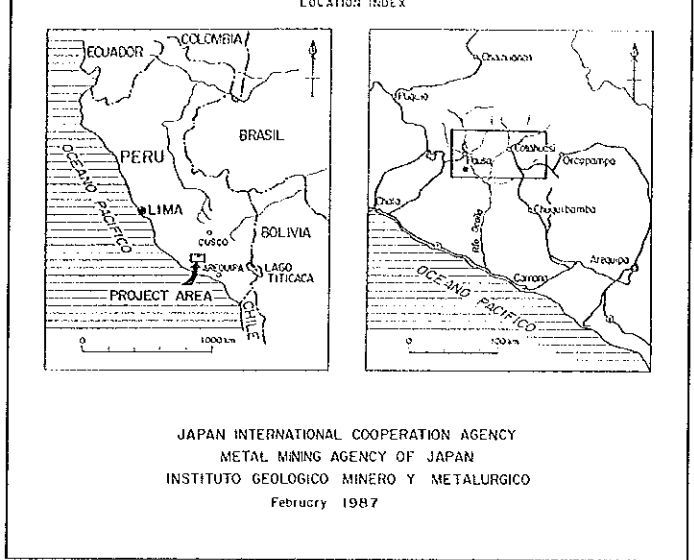
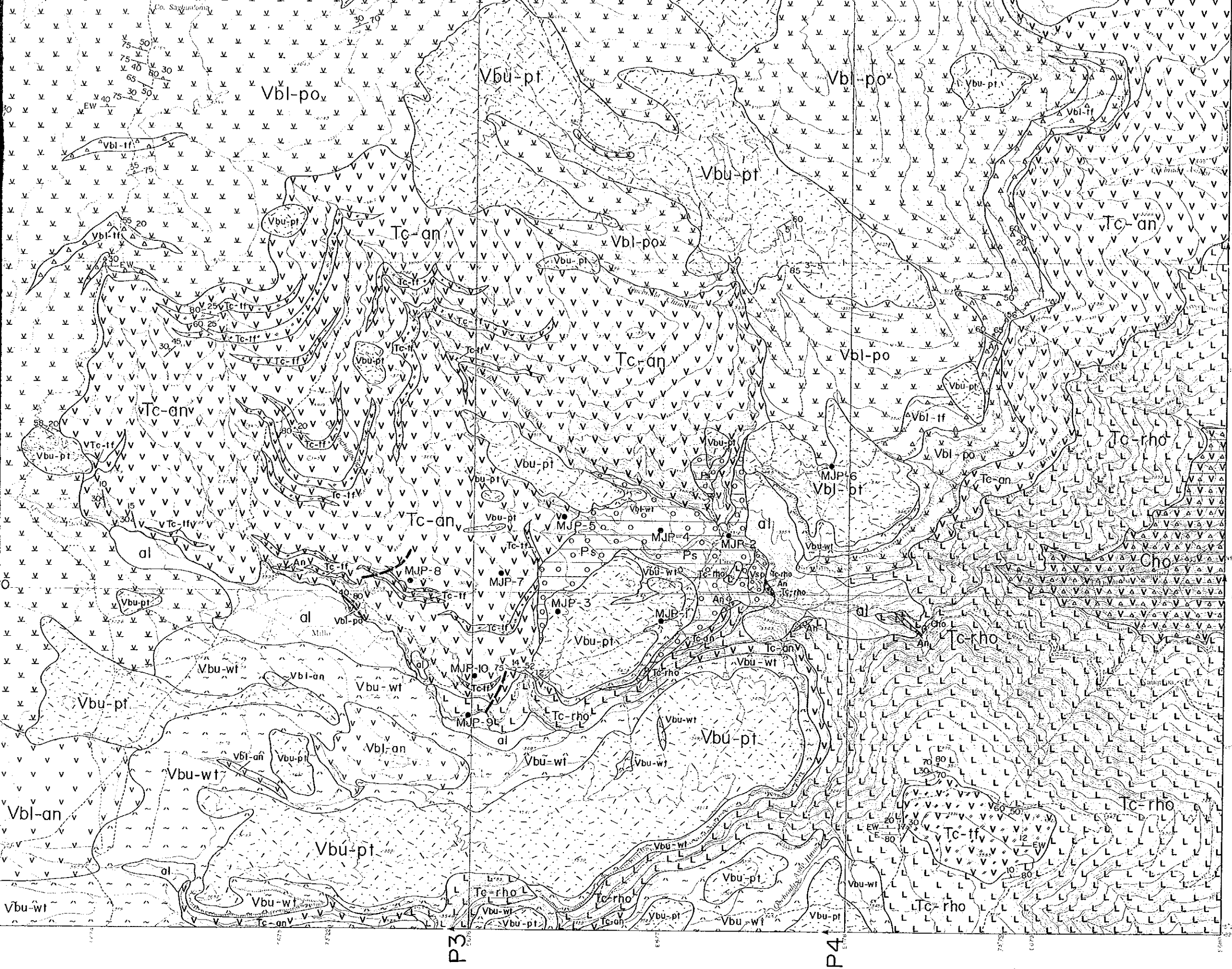


LEGEND

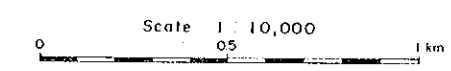
Holocene	Alluvium and Talus	al	Gravel, sand, silt and clay
	Volcanic Sediments of Pausa	Vo-VsP	Volcanic ash and gravel
Quaternary	Moraine Sediments	Mo	Gravel, sand and mud
	Borroso Group	Upper Formation Vbu-pf Vbu-wt	Pumice fall and tuffaceous sand Dacite lava, dacitic tuff and welded tuff
Pleistocene	Lower Formation	Vbu-lf	Andesitic tuff, lapilli tuff and tuff breccia
	Pirca Sediments	Pi	Hornblende andesite lava
Tertiary	Miocene	Tacaiza Formation	Andesitic tuff, lapilli tuff and tuff breccia Andesite lava with thin bedded tuff, lapilli tuff and tuff breccia
	Jurassic	Chocolate Volcanic Rocks	Rhyolite lava, tuff and lapilli tuff Andesite lava, andesitic tuff and tuff breccia (partly green samschist)
Intrusive rock			
Dike		vAn	Hornblende andesite
Fault			Fault
Strike and dip of bedding		80°-80°	Strike and dip of bedding
Strike and dip of flow structure		50°-10°	Strike and dip of flow structure
Strike and dip of joint		80°-75°	Strike and dip of joint







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LEGEND

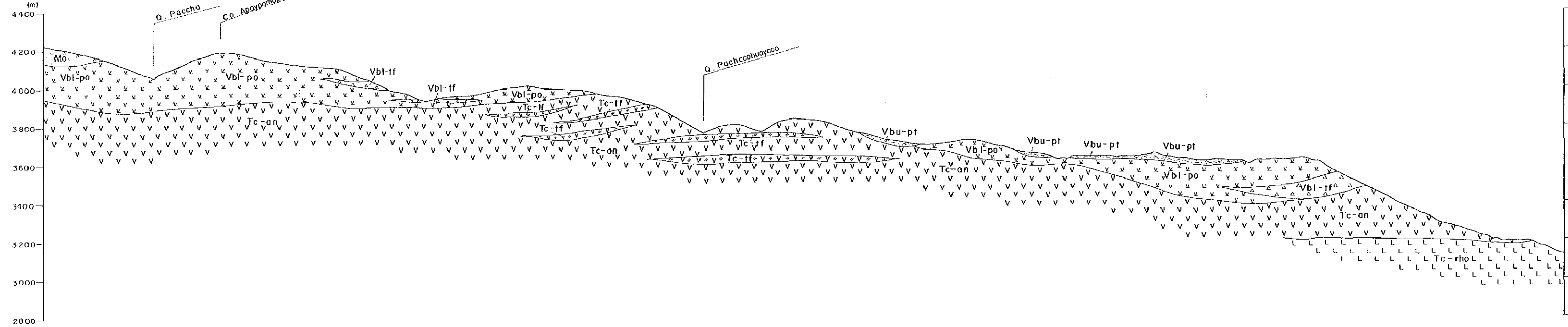
Quaternary	Holocene	Alluvium and Talus	al	Gravel, sand, silt and clay	
		Volcanic Sediments of Pausa	o-o-o-o o-o-o-o o-o-o-o	Volcanic ash and gravel	
Quaternary	Pleistocene	Moraine Sediments	o-o-o-o o-o-o-o o-o-o-o	Gravel, sand and mud	
		Barroso Group	Upper Formation	vbu-pt vbu-pt vbu-pt	Pumice fall and tuffaceous sand
			Lower Formation	vbi-po vbi-po vbi-po	Dacite lava, dacitic tuff and welded tuff
		Pirca Sediments		al al al	Pyroxene andesite tuffs
	al al al		Andesitic tuff, lapilli tuff and tuff breccia		
Tertiary	Miocene	Tacaza Formation	vbi-po vbi-po vbi-po	Hornblende andesite lava	
		Chocolate Volcanic Rocks	vbi-po vbi-po	Andesitic tuff, lapilli tuff and tuff breccia	
			vbi-po vbi-po	Andesite lava with thin bedded tuff, lapilli tuff and tuff breccia	
Intrusive rock			l-l-l-l l-l-l-l	Rhyolite lava, tuff and lapilli tuff	
			vbi-po vbi-po	Andesite lava, andesitic tuff and tuff breccia (partly green semischist)	
	Dike		v-v-v-v v-v-v-v	Hornblende andesite	
			— / —	Fault	
			80° 80°	Strike and dip of bedding	
			50° 10°	Strike and dip of flow structure	
			30° 75°	Strike and dip of joint	
	10° 80°	Strike and dip of dike			
		MJP-1	Location of drilling		
		P1 — P1	Geological Profile line		

P1

(m)

4400
4200
4000
3800
3600
3400
3200
3000
2800

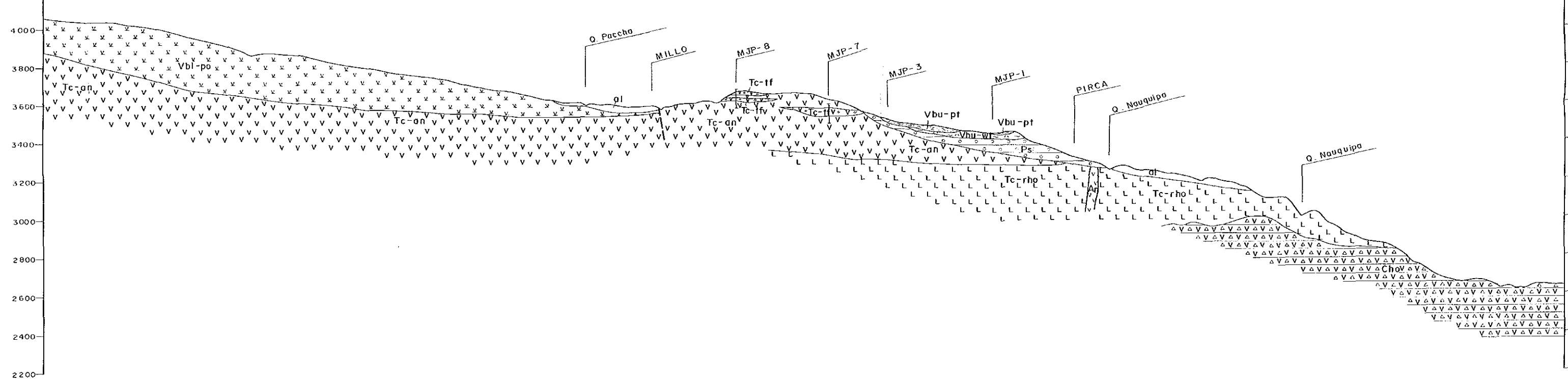
(E-W Section)



P2

(m)

4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200

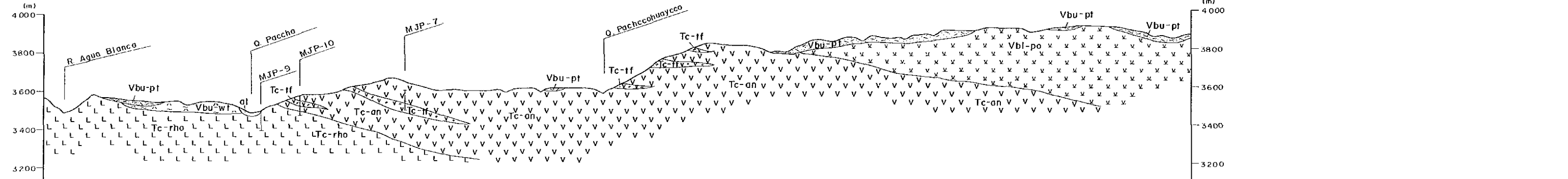


(N-S Section)

P3

(m)

4000
3800
3600
3400
3200

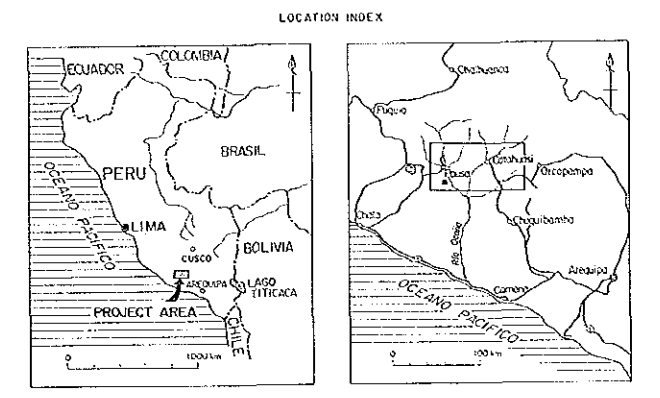


P3'

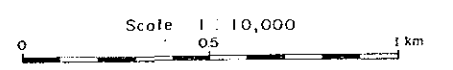
(m)

4000
3800
3600
3400
3200

GEOLOGICAL PROFILES
OF THE PIRCA EASTERN AREA



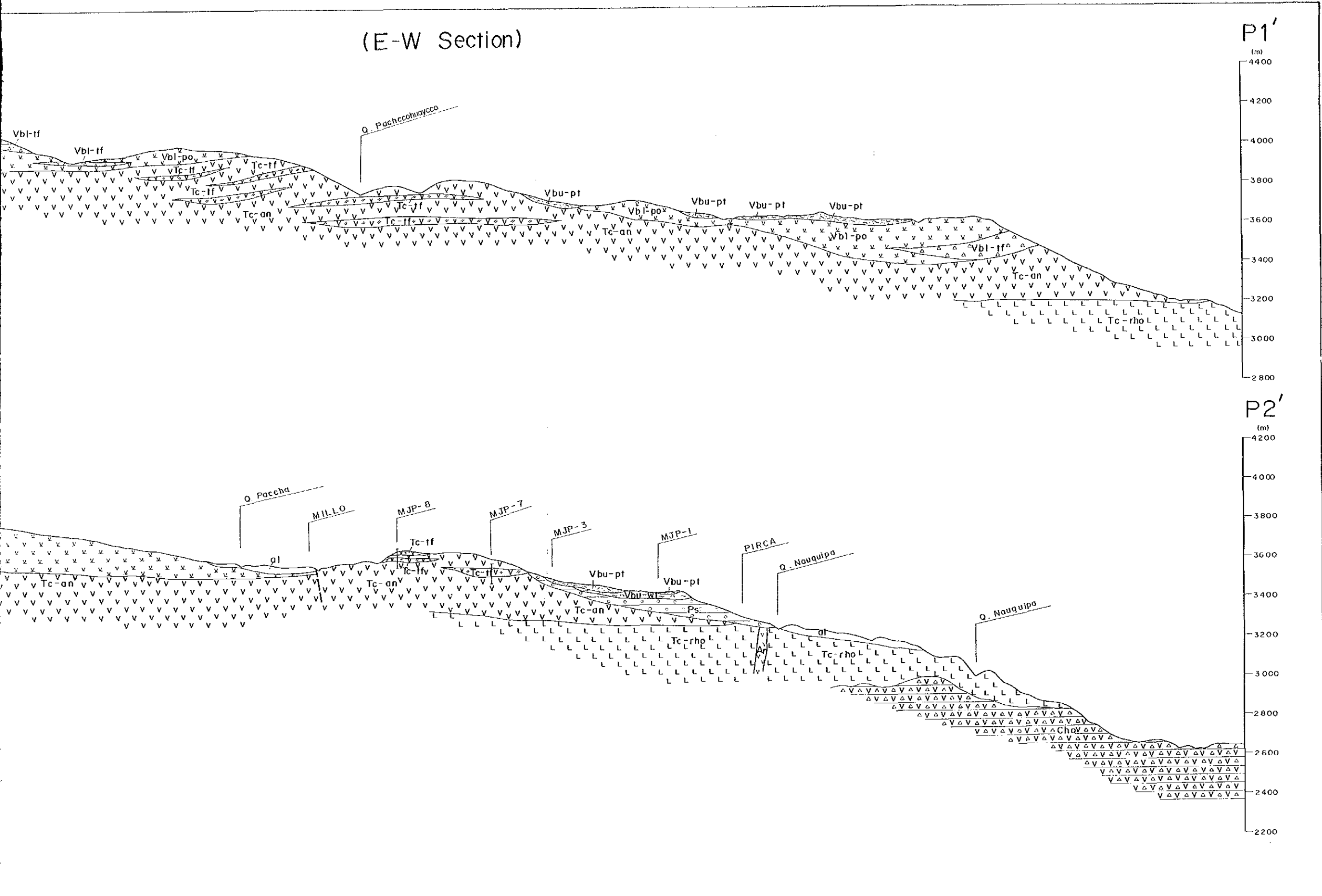
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METAL MINING AGENCY OF JAPAN
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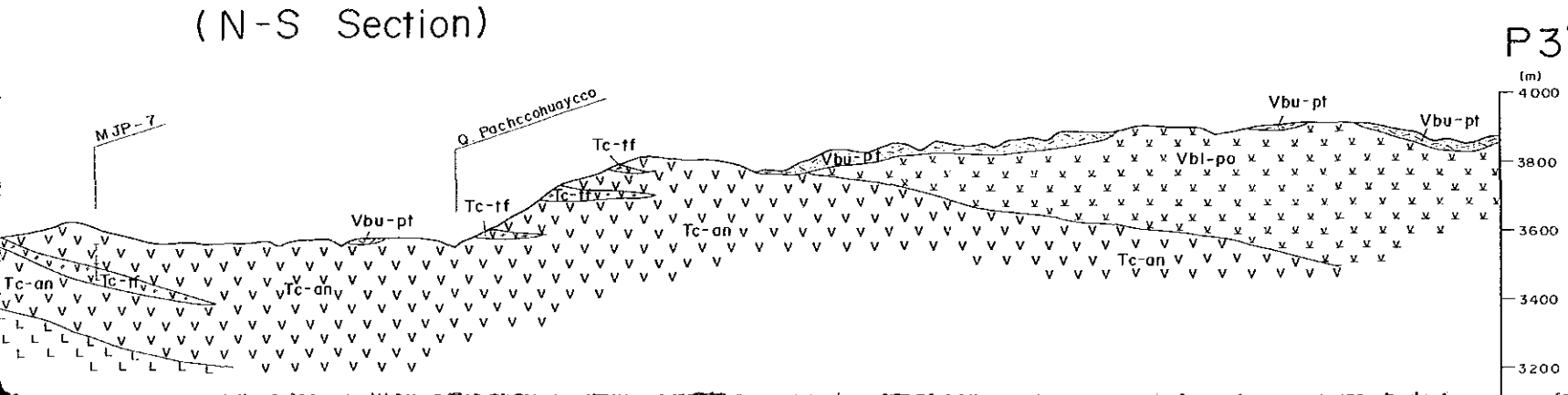
LEGEND

Quaternary	Holocene	Alluvium and Talus	al	Gravel, sand, silt and clay
		Volcanic Sediments of Pausa	o-o-o-o o-o-o-o o-o-o-o	Volcanic ash and gravel
		Moraine Sediments	o o o o o o	Gravel, sand and mud
	Pleistocene	Upper Formation	Vbu-pt	Pumice fall and tuffaceous sand
			Vbu-wt	Dacite lava, dacitic tuff and welded tuff
		Lower Formation	Vb-an	Olivine basalt and pyroxene andesite lavas
			Vb-ft Vb-po	Andesitic tuff, lapilli tuff and tuff breccia
	Pirca Sediments	o o o o o o	Gravel, sand, silt and clay	
	Tertiary	Miocene	Tc-an	Andesitic tuff, lapilli tuff and tuff breccia
			Tc-an	Andesite lava with thin bedded tuff, lapilli tuff and tuff breccia
Chocolate Volcanic Rocks		Tc-rho	Rhyolite lava, tuff and lapilli tuff	
		Chav	Andesite lava, andesitic tuff and tuff breccia (partly green semischist)	
Jurassic	Intrusive rock	Dike	Hornblende andesite	
		Fault	Fault	

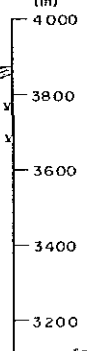
(E-W Section)



(N-S Section)

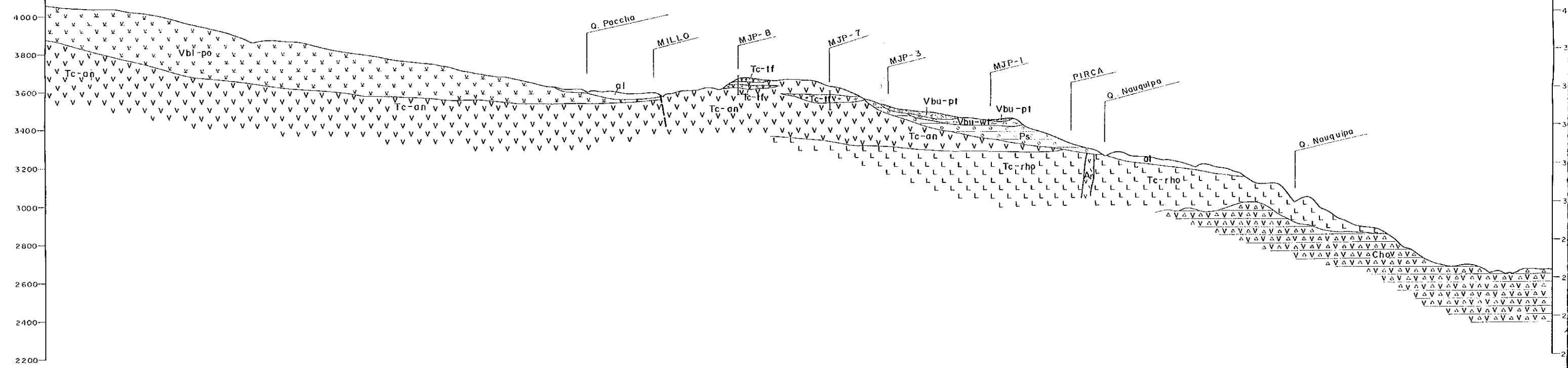
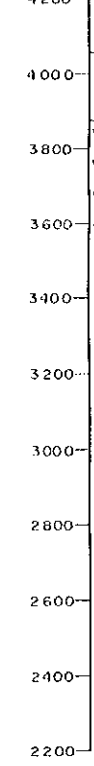


P3'



P2

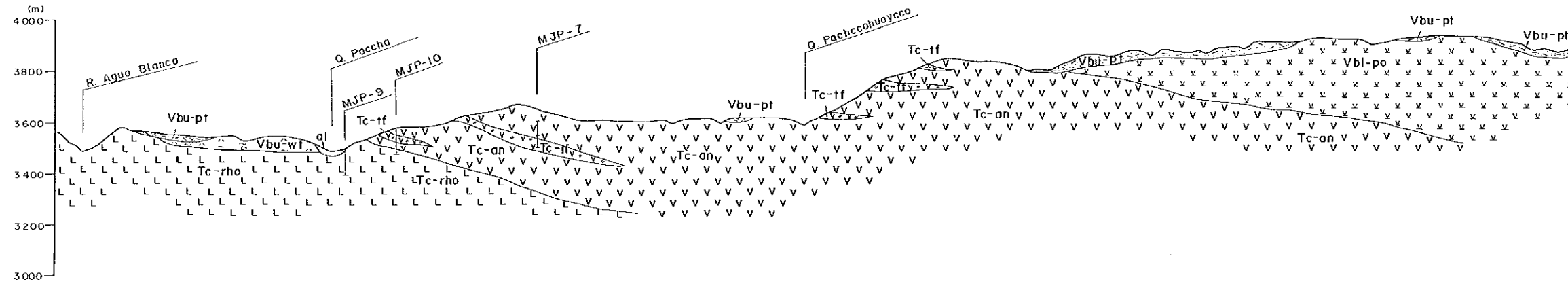
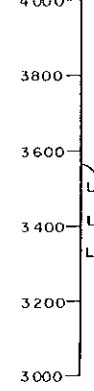
(m)



(N-S Section)

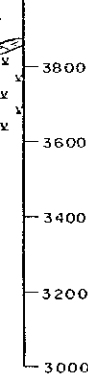
P3

(m)



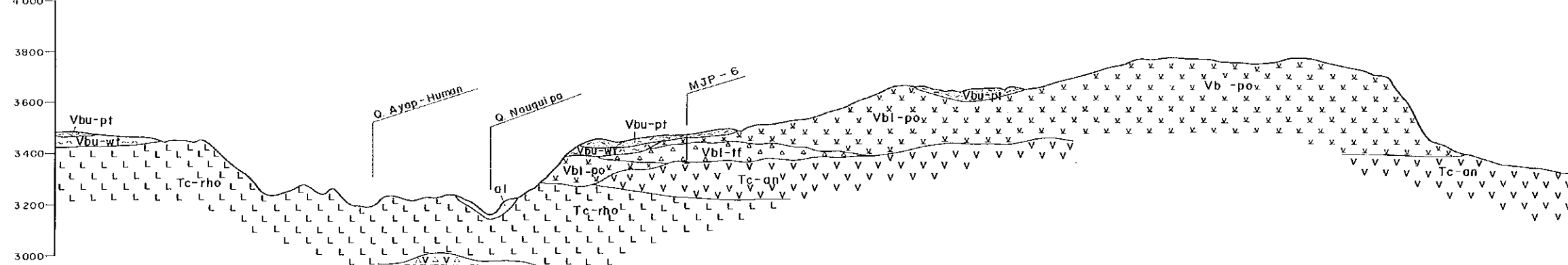
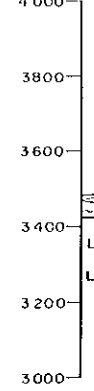
P3'

(m)



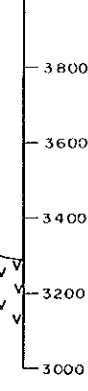
P4

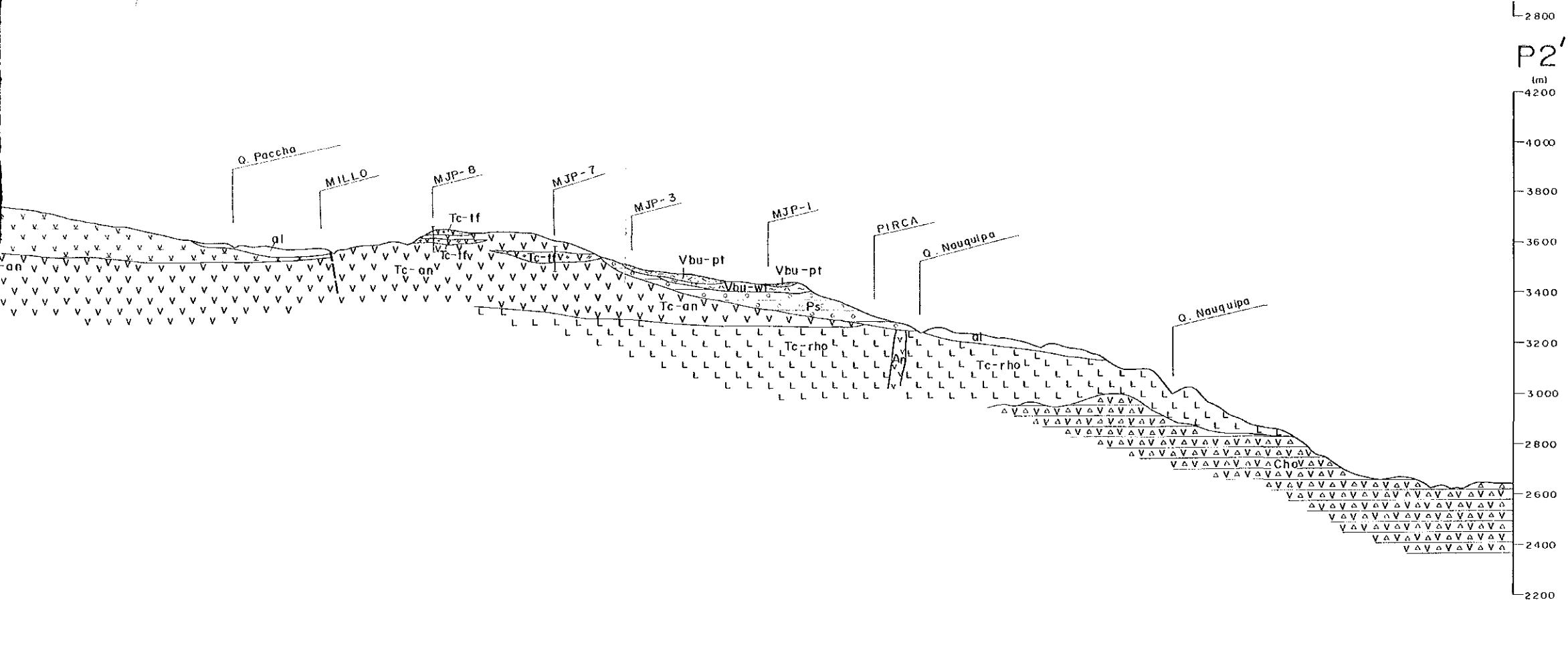
(m)



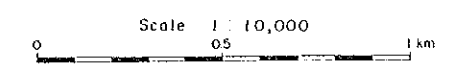
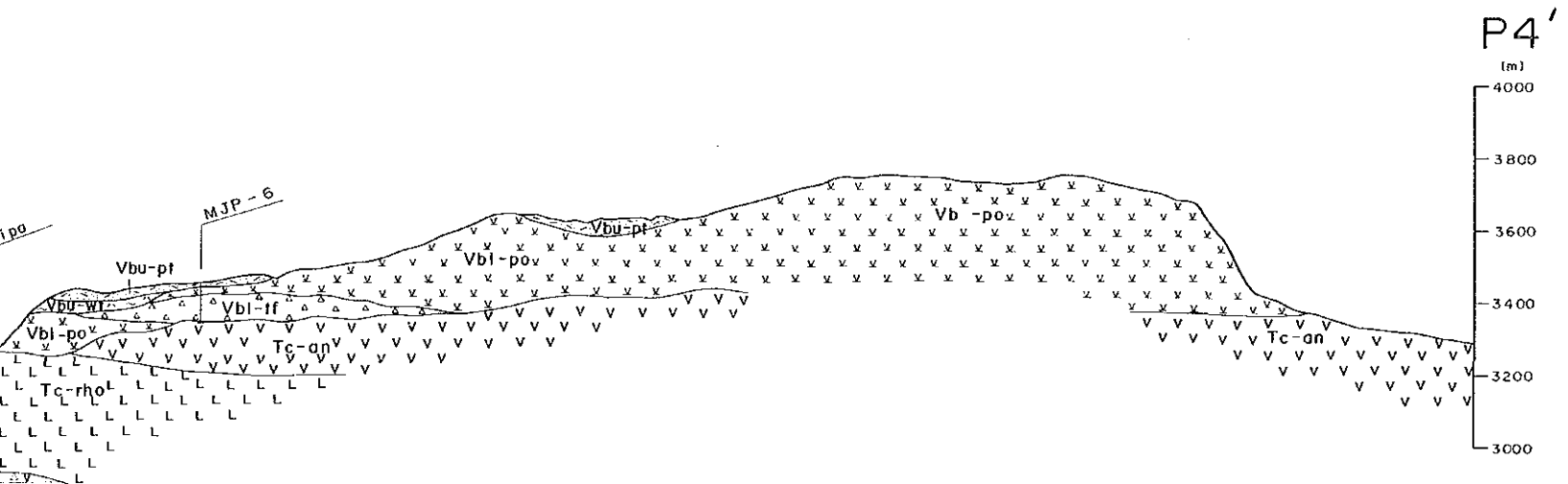
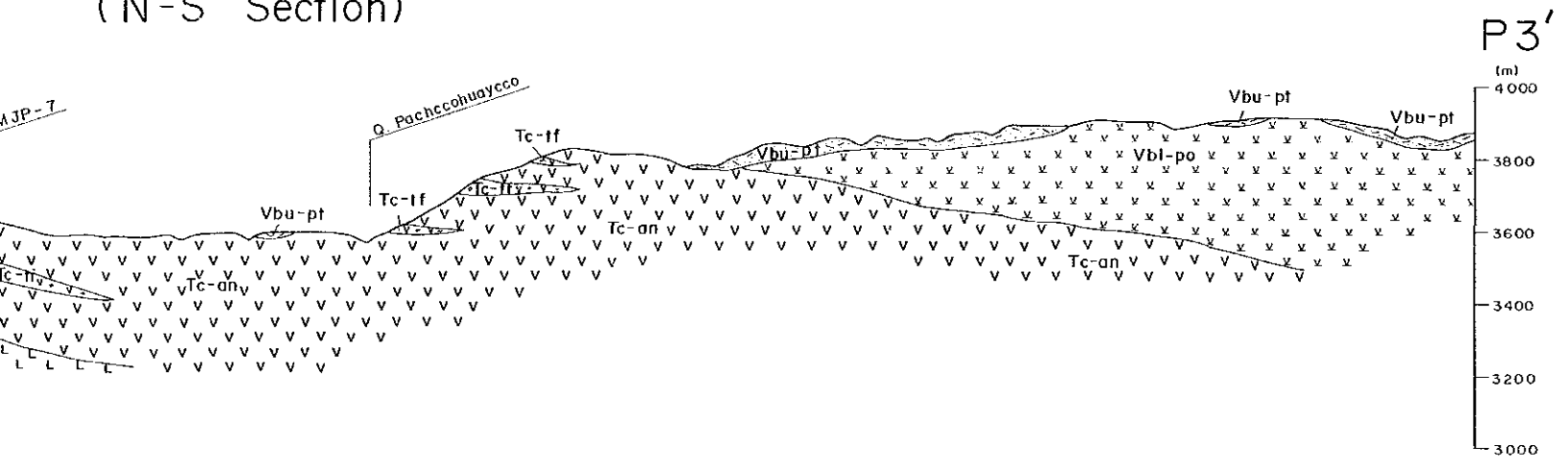
P4'

(m)



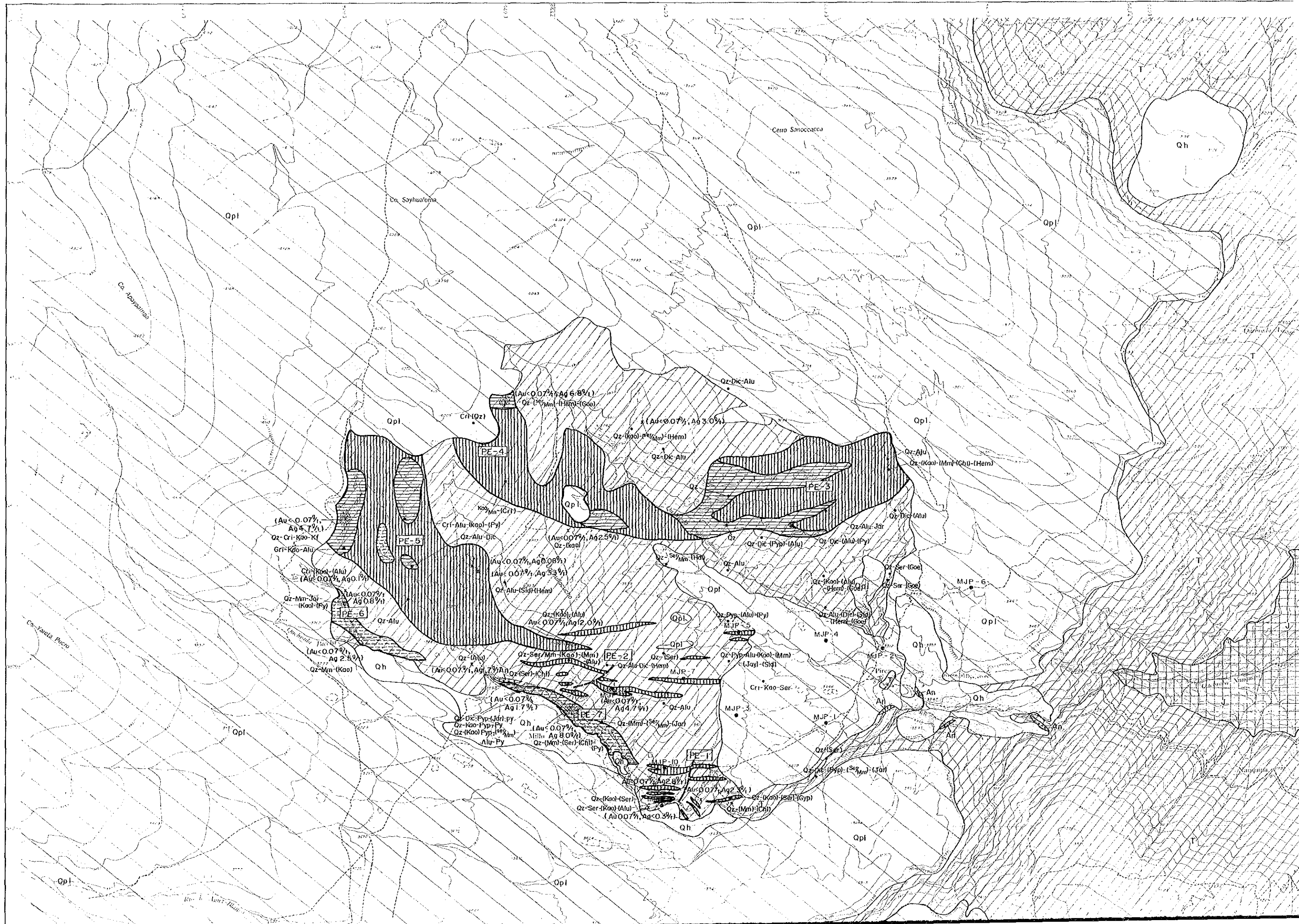


(N-S Section)



LEGEND

Quaternary	Holocene	Alluvium and Talus	al	Gravel, sand, silt and clay	
		Volcanic Sediments of Pausa	o-o-v-s-p	Volcanic ash and gravel	
	Pleistocene	Barroso Group - Upper Formation	vbu-pt	Pumice fall and tuffaceous sand	
		Barroso Group - Lower Formation	vbu-wt	Dacite lava, dacitic tuff and welded tuff	
	Tertiary	Pliocene	Pirca Sediments	o-o-ps	Gravel, sand, silt and clay
			Tacozza Formation	v-tc-if	Andesitic tuff, lapilli tuff and tuff breccia
		Miocene	Tacozza Formation	v-tc-an	Andesite lava with thin bedded tuff, lapilli tuff and tuff breccia
			Tacozza Formation	v-tc-rho	Rhyolite lava, tuff and lapilli tuff
	Jurassic	Chocolate Volcanic Rocks	v-ch	Andesite lava, andesitic tuff and tuff breccia (partly green semischist)	
	Intrusive rock				
Dike		v-an	Hornblende andesite		
Fault					
Strike and dip of bedding		80°-80°			
Strike and dip of flow structure		50°-10°			
Strike and dip of joint		80°-75°			
Strike and dip of dike		70°-80°			
Location of drilling		MJP-1			




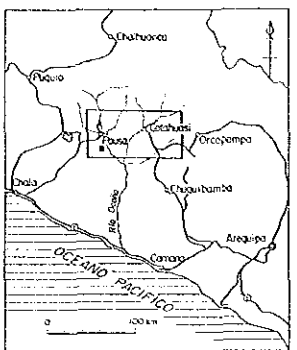


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MINERAL EXPLORATION
IN
COTAHUASI AREA
(PHASE II)

LOCATION MAP OF ALTERATION AND
MINERALIZATION ZONES OF THE
PIRCA EASTERN AREA

LOCATION INDEX

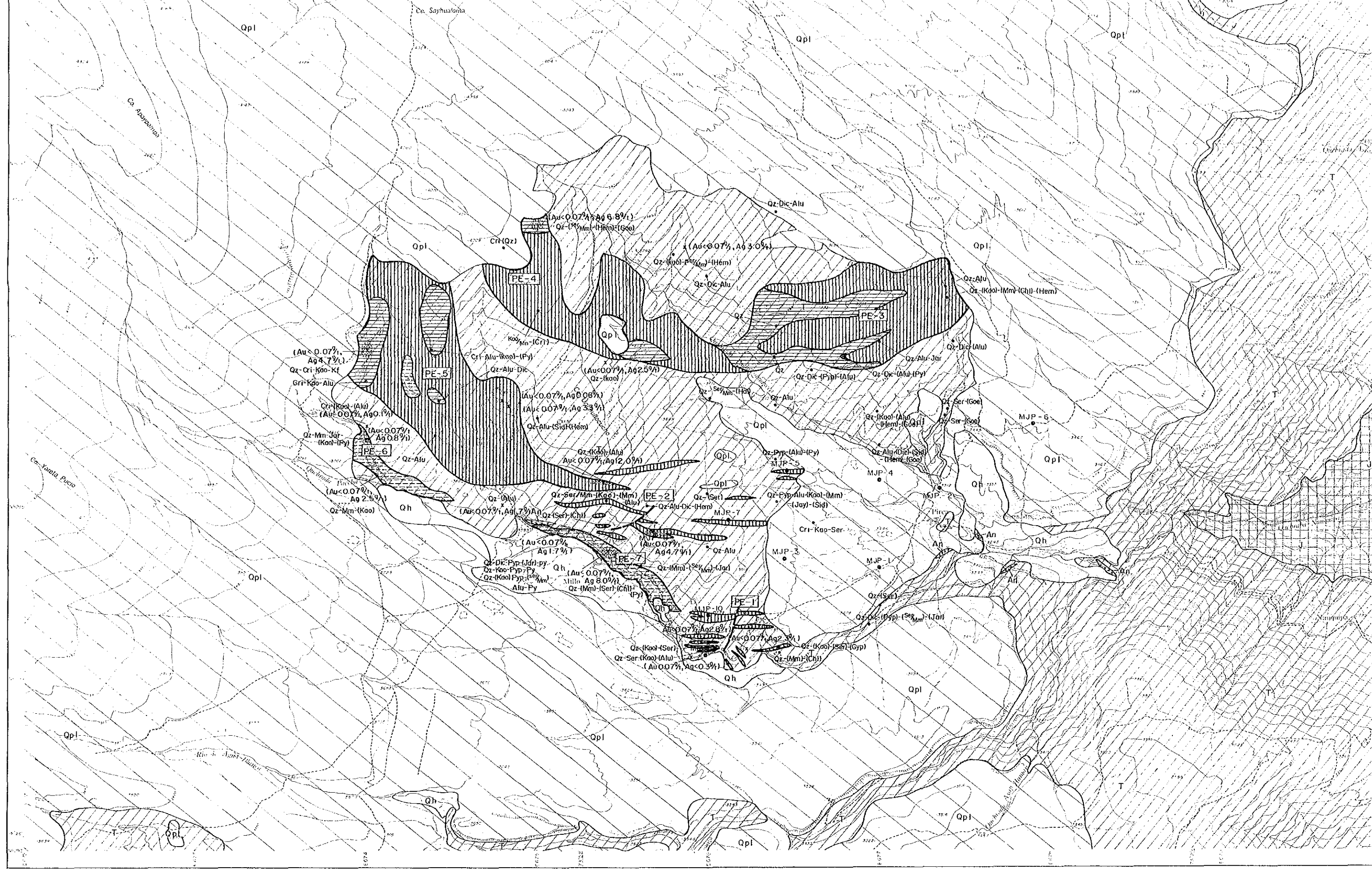



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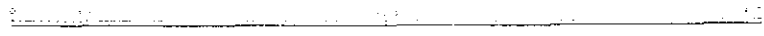
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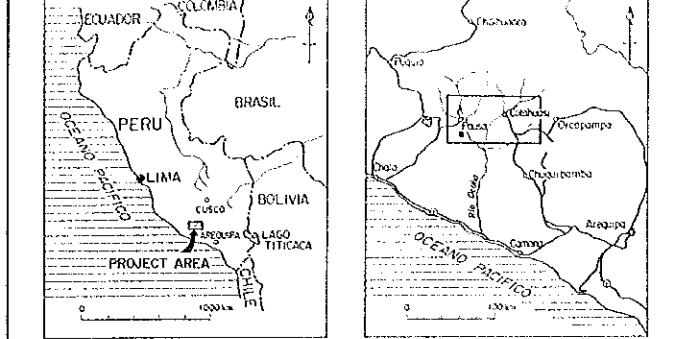
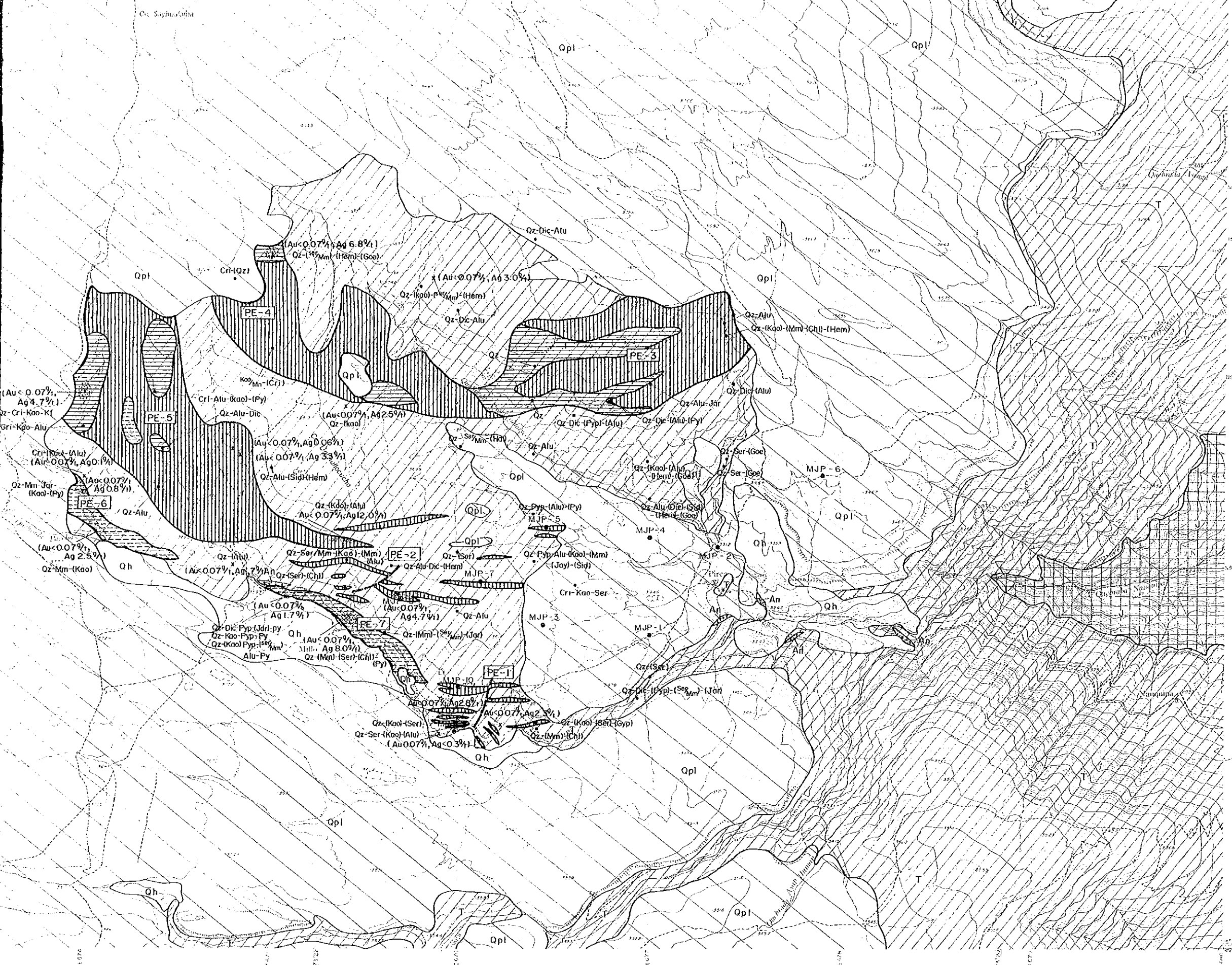
LEGEND

Geological System	Abbreviation
Quaternary (Holocene) System	Qz : quartz
Quaternary (Pleistocene) System	Kf : potassium feldspar
Tertiary System	Cri : α-cristobalite
Jurassic System	Hai : halloysite
	Kao : kaolinite
	Dic : dickite
	Pyp : pyrophyllite
	Mm : montmorillonite
	Ser : sericite
	Chl : chlorite
	Kao/Mm : kaolinite-montmorillonite mixed layer
	Ser/Mm : sericite-montmorillonite mixed layer
Hornblende andesite	
Fault	
Mainly silicification	Alu : alunite
Silicification and argillization	Jor : jarosite
Mainly argillization	Gyp : gypsum
Mineralization	Py : pyrite
	Hem : hematite
	Goe : goethite

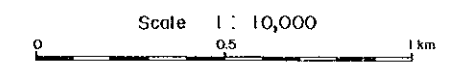


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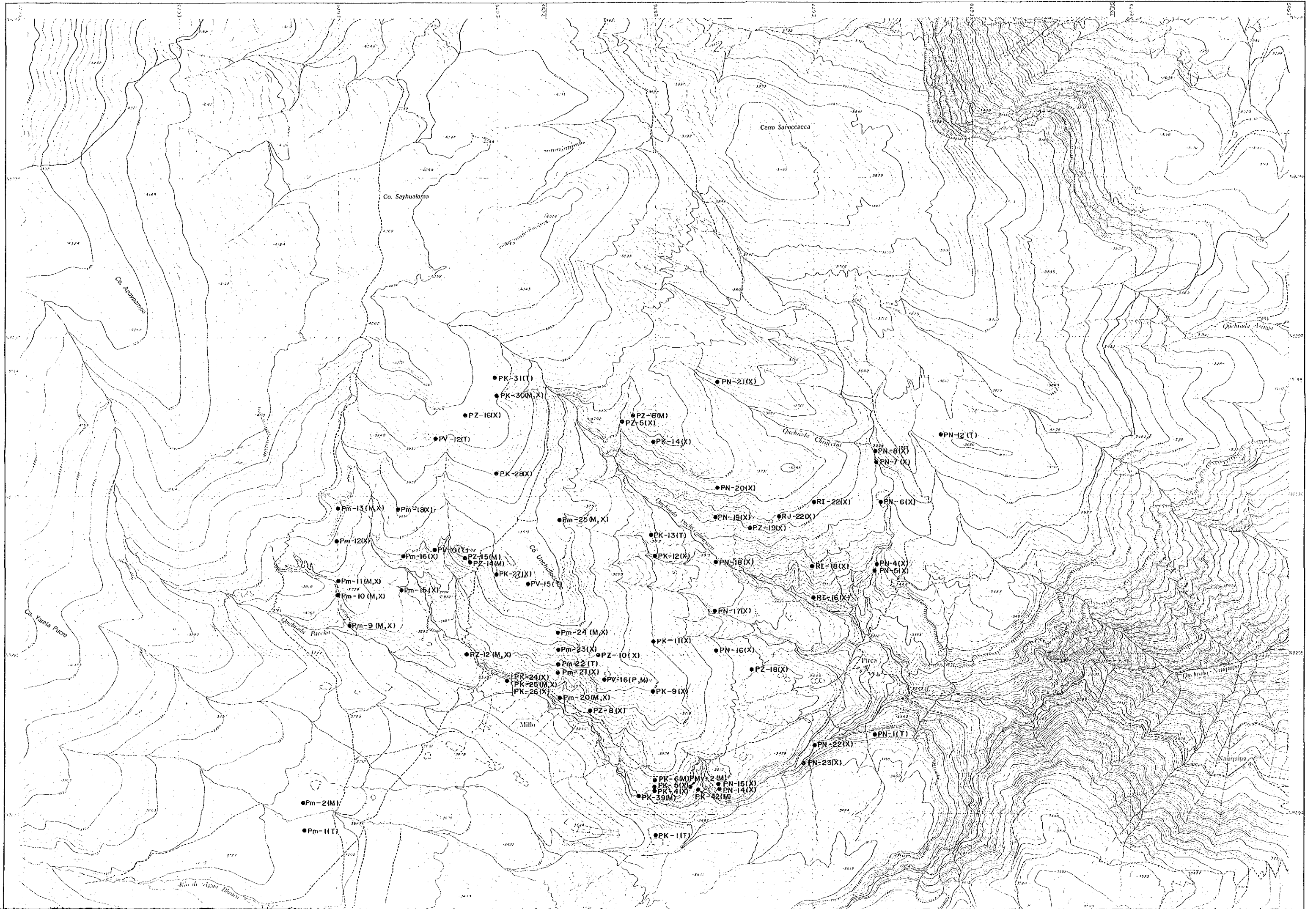
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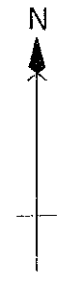
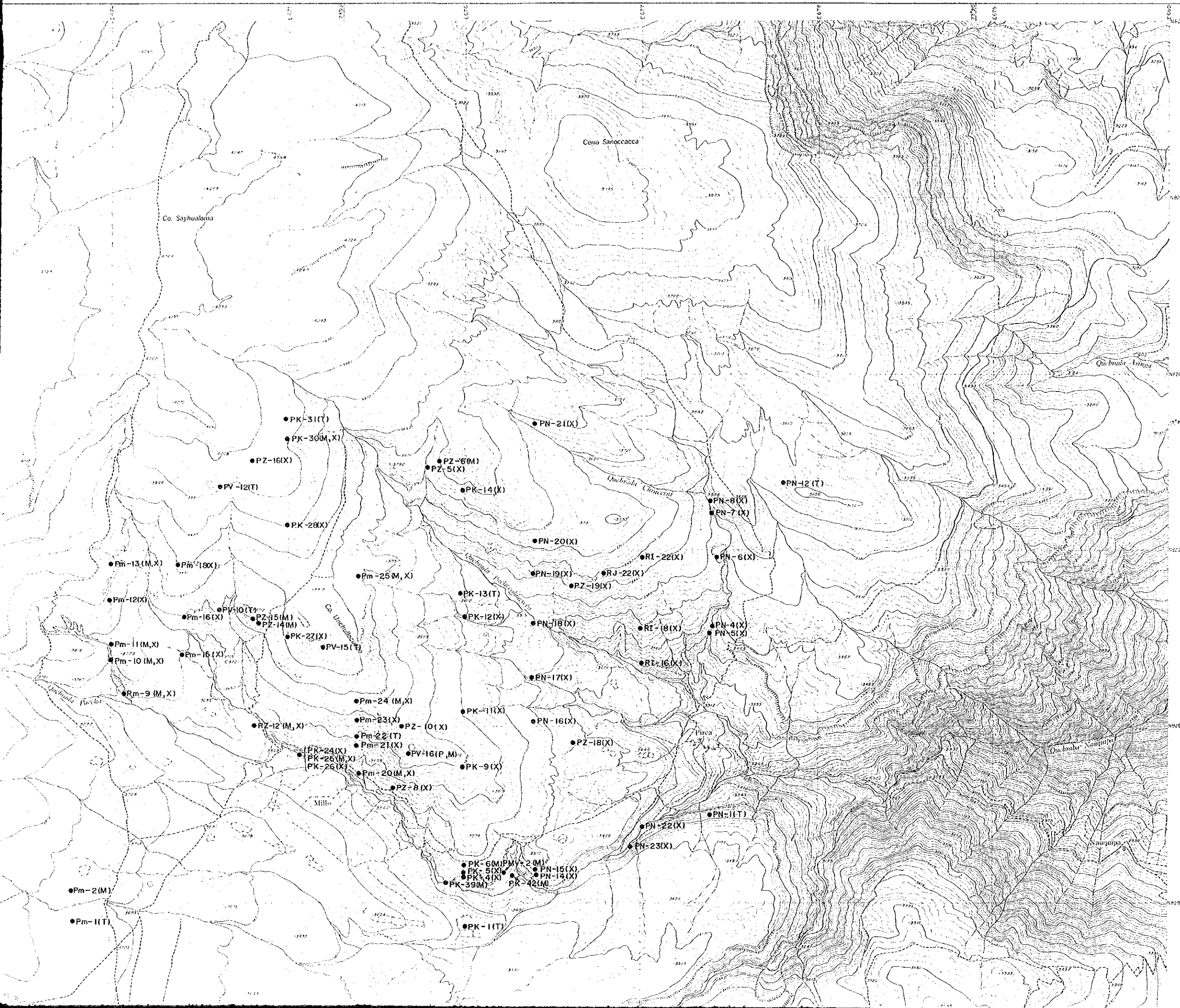


LEGEND

Geological System	Abbreviation
Quaternary (Holocene) System	Qz : quartz
Quaternary (Pleistocene) System	Kf : potassium feldspar
Tertiary System	Cri : α-cristobalite
Jurassic System	Hal : halloysite
	Kao : kaolinite
	Dic : dickite
	Pyp : pyrophyllite
	Mm : montmorillonite
	Ser : sericite
	Chl : chlorite
	Kao/Mm : kaolinite-montmorillonite mixed layer
	Ser/Mm : sericite-montmorillonite mixed layer
	Atu : alunite
	Jar : jarosite
	Gyp : gypsum
	Py : pyrite
	Hem : hematite
	Goe : goethite

1 : 10,000



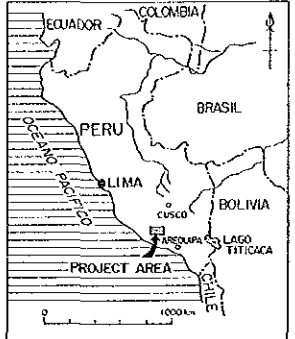
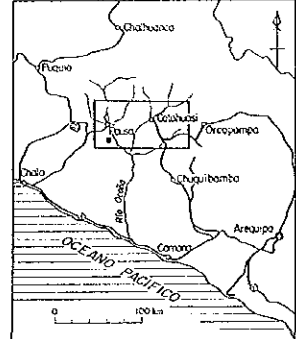


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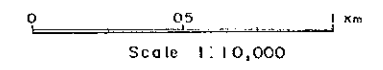
MINERAL EXPLORATION
IN
COTAHUASI AREA
(PHASE II)

LOCATION MAP OF ROCK AND
ORE SAMPLES OF
THE PIRCA EASTERN AREA

LOCATION INDEX

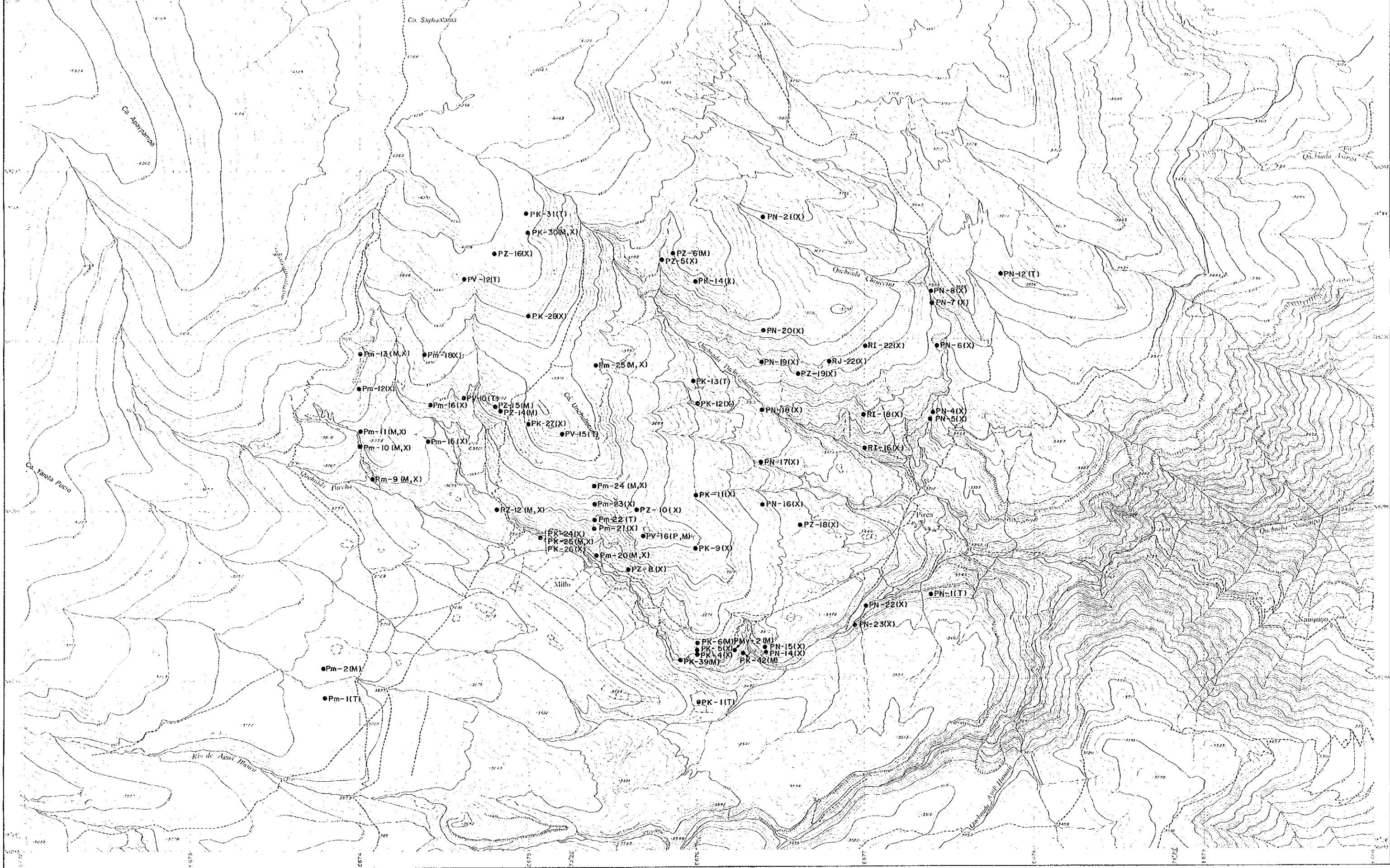



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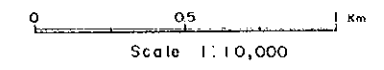
LEGEND

- (P) : Polished Section
- (T) : Thin Section
- (X) : X-Ray Powder diffraction
- (M) : Chemical Analysis of Ore



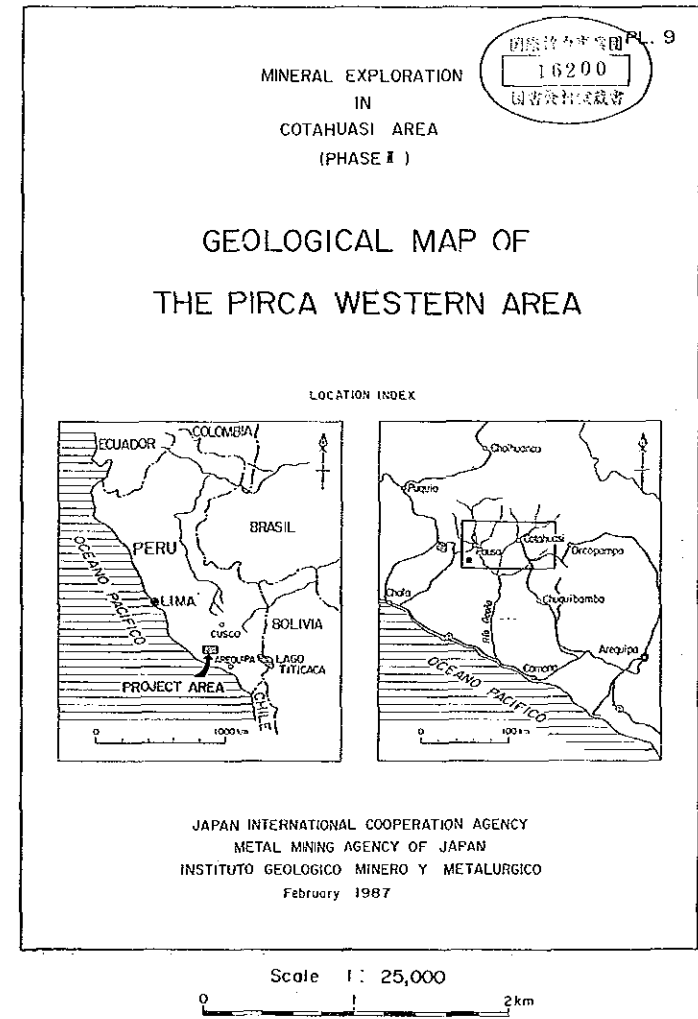
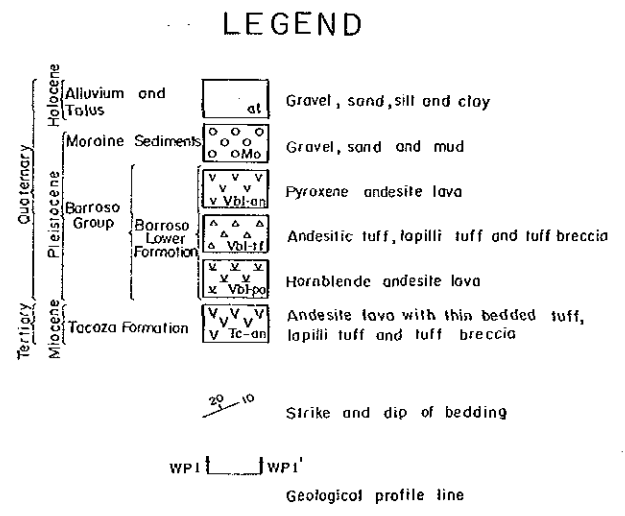
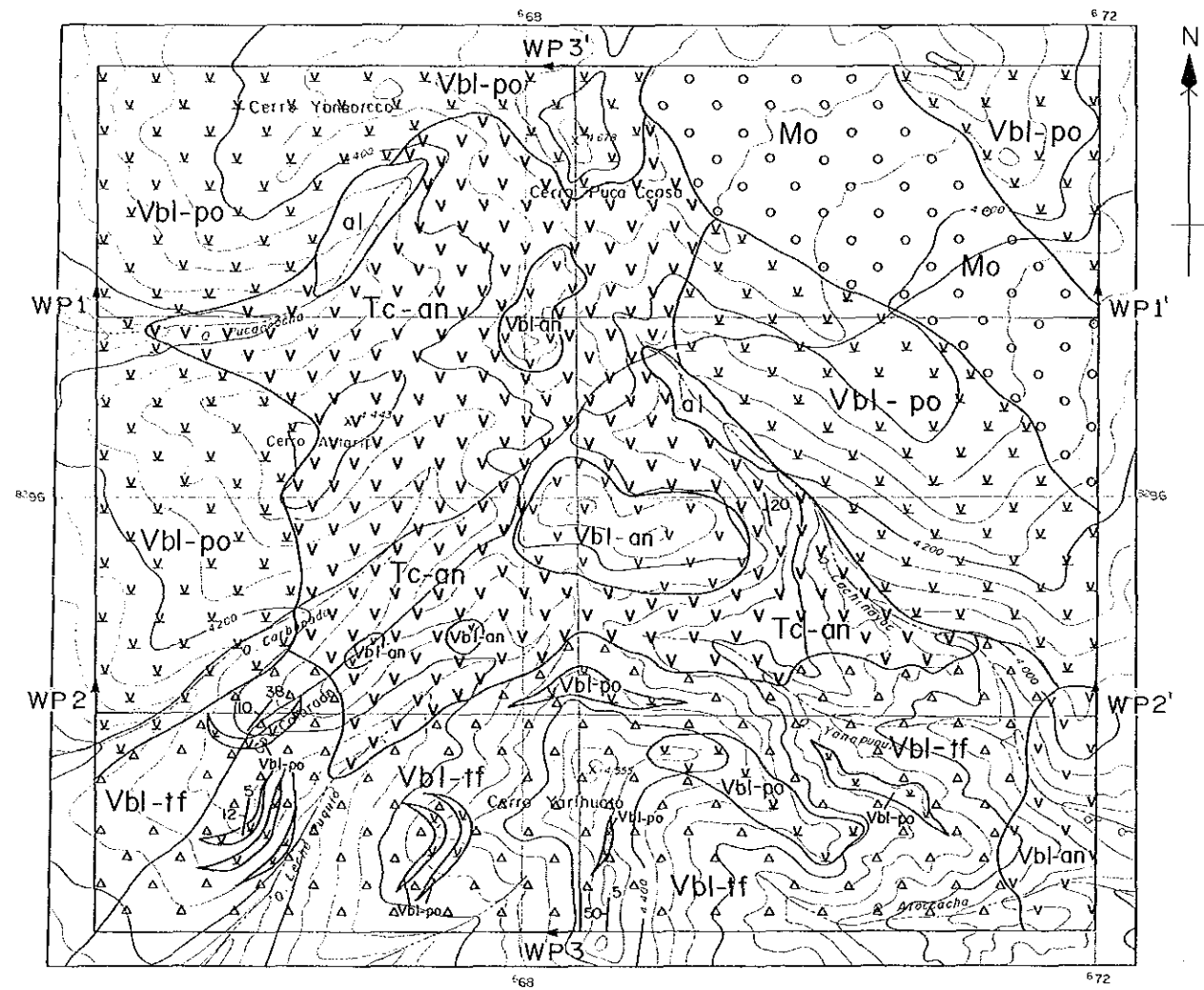


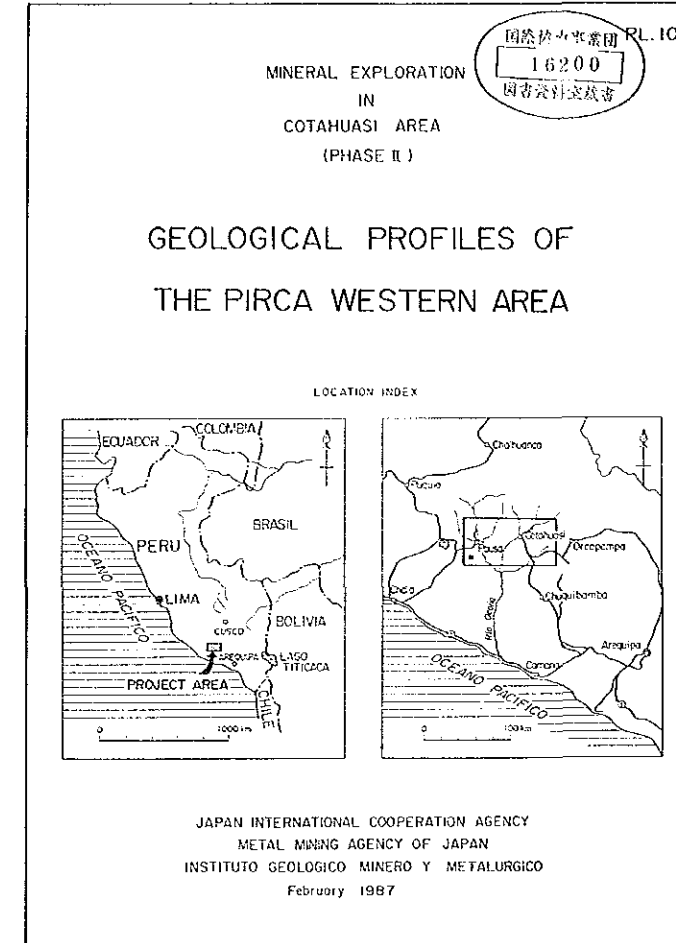
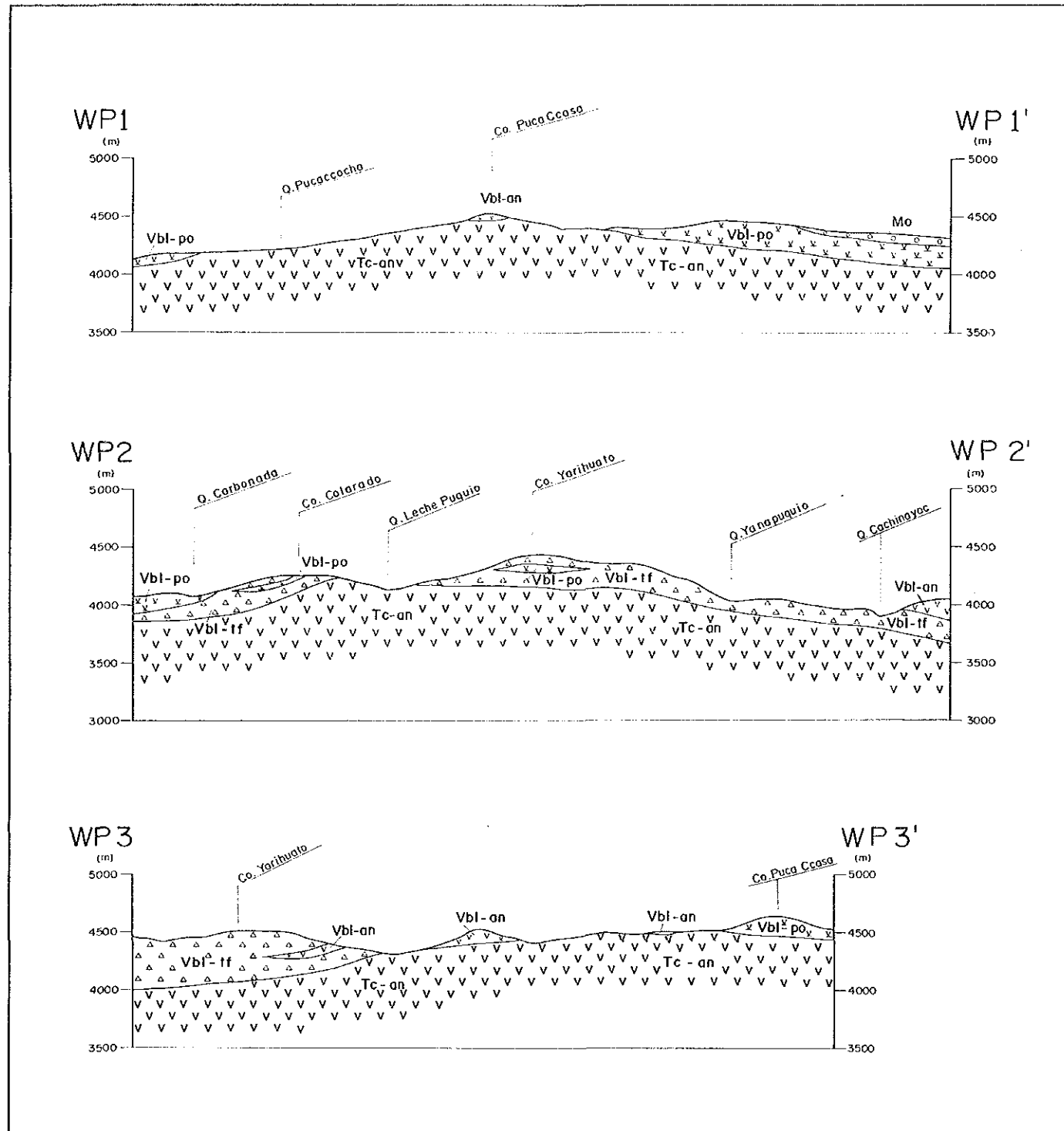
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 February 1987



LEGEND

- (P) : Polished Section
- (T) : Thin Section
- (X) : X-Ray Powder diffraction
- (M) : Chemical Analysis of Ore

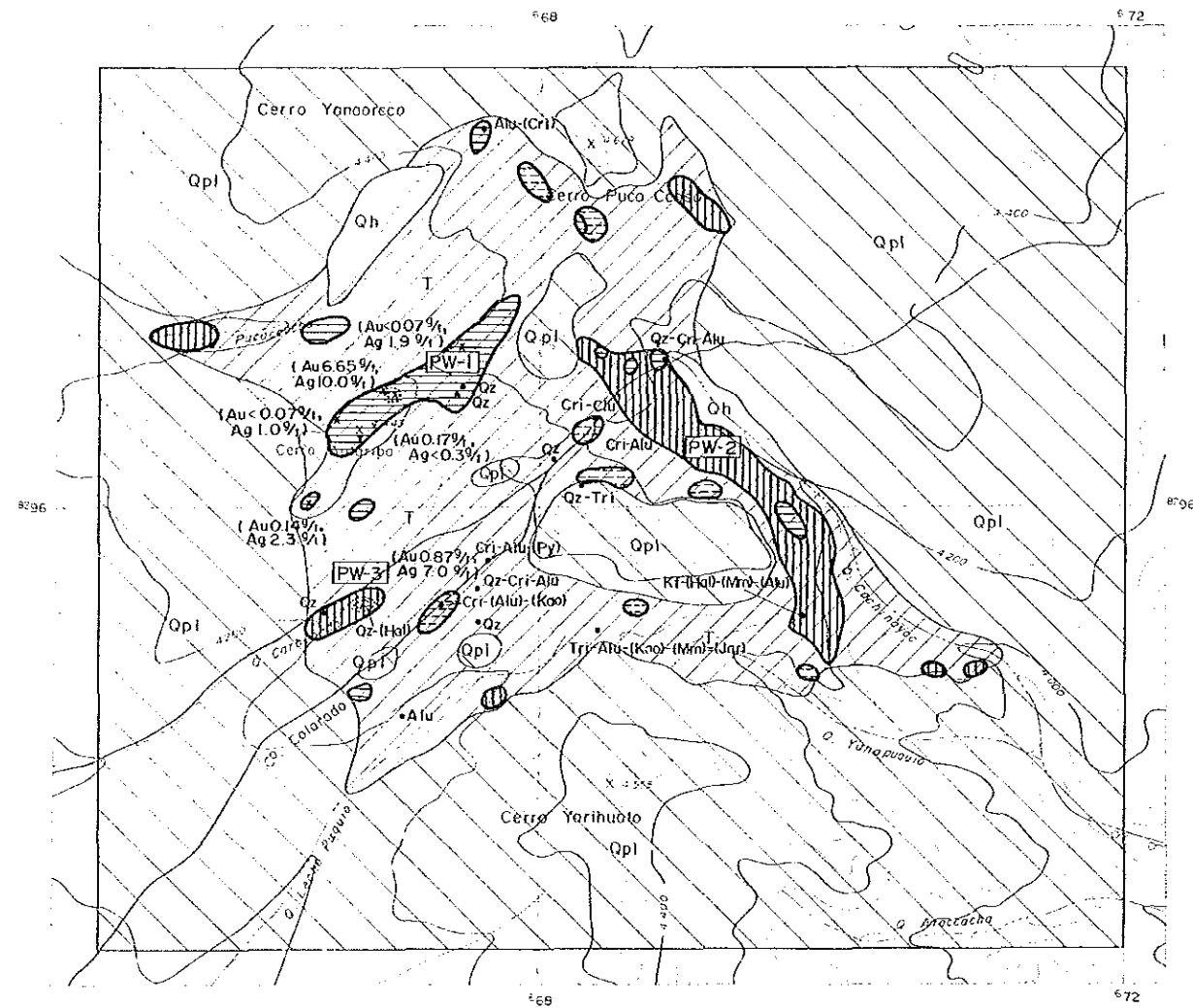




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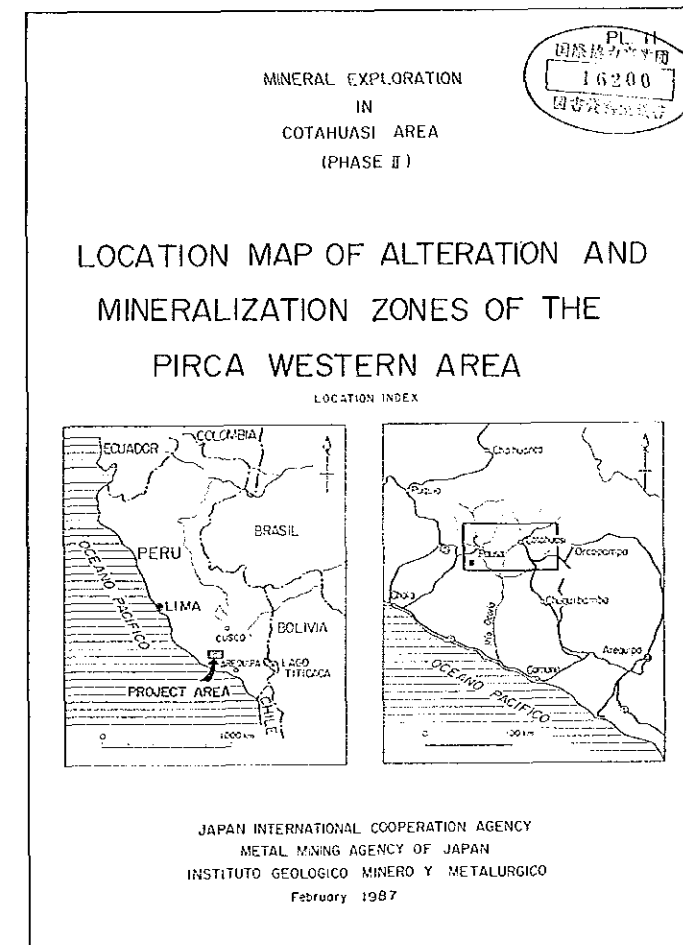
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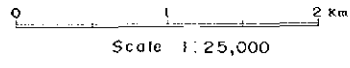
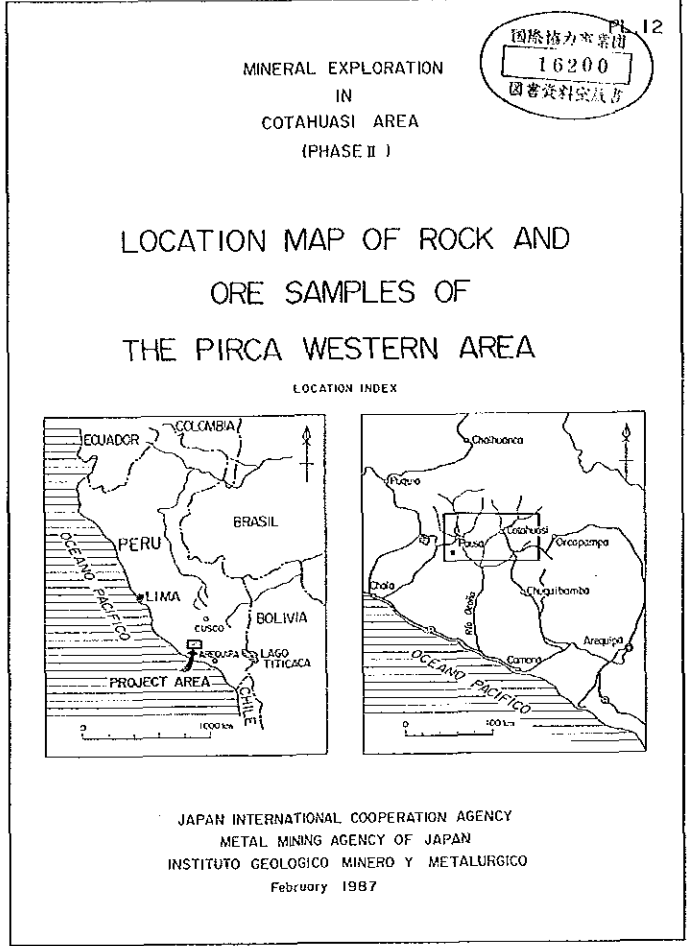
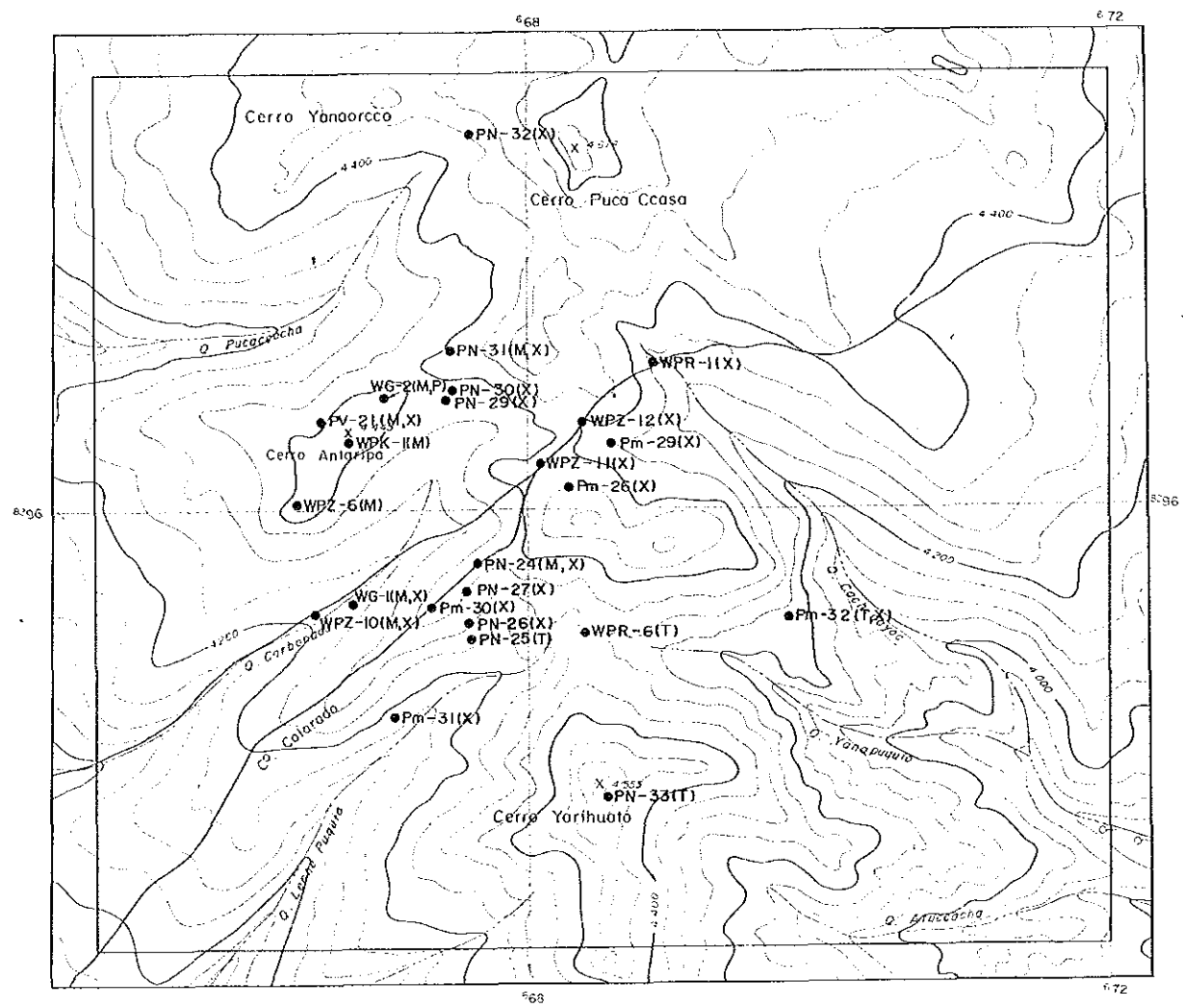
Tertiary	Miocene	Tacaza Formation		Andesite lava with thin bedded tuff, lapilli tuff and tuff breccia
		Pliocene	Barroso Lower Formation	
Quaternary	Barroso Group			Pyroxene andesite lava
			Moraine Sediment	
Holocene			Alluvium and Talus	
			Gravel, sand, silt and clay	



LEGEND

- Geological System**
- Qh Quaternary (Holocene) System
 - Qpl Quaternary (Pleistocene) System
 - T Tertiary System
- Alteration and Mineralization Zones**
- Mainly silicification
 - Silicification and argillization
 - Mainly argillization
 - Mineralization
- Abbreviation**
- Qz: quartz
 - Tri: triphylite
 - Cri: α -crisobalite
 - Alu: alunite
 - Jar: jarosite
 - Hal: halloysite
 - Koo: kaolinite
 - Mm: montmorillonite





LEGEND

- | | |
|------------------------|--------------------------------|
| (P) : Polished Section | (X) : X-Ray Powder diffraction |
| (T) : Thin Section | (M) : Chemical Analysis of Ore |