

COTAHUASI

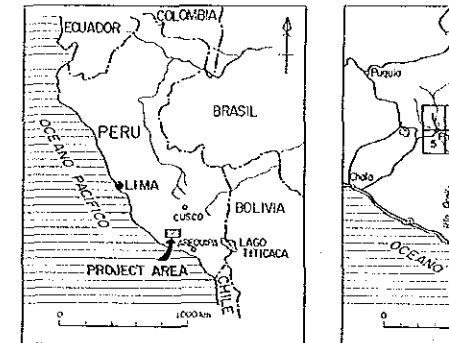
1	2	3	4
5	6	7	8



MINERAL EXPLORATION
IN
COTAHUASI AREA
(PHASE I)

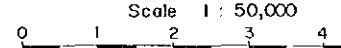
GEOLOGICAL MAP THE REGIONAL SURVEY (4)

LOCATION INDEX



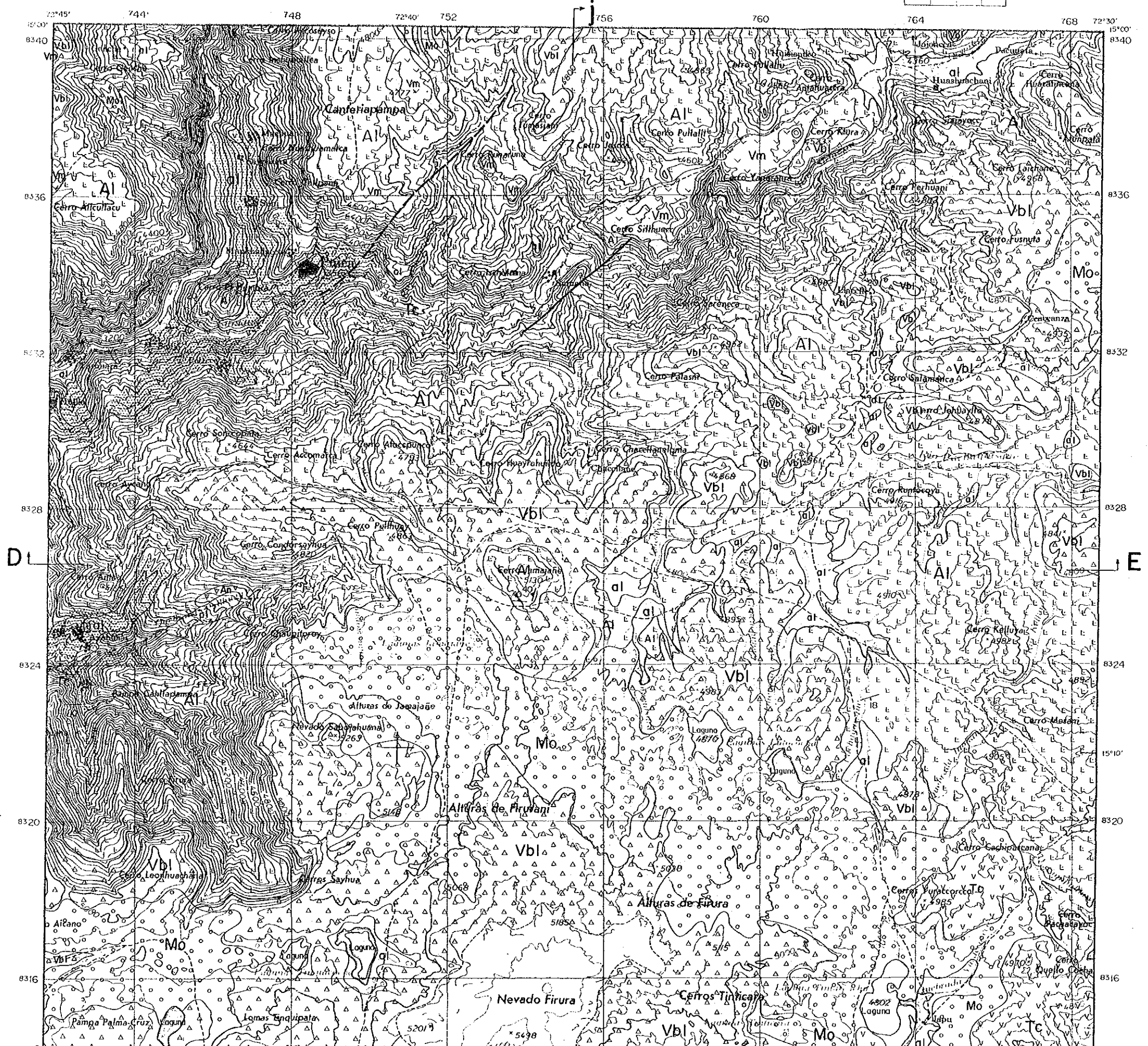
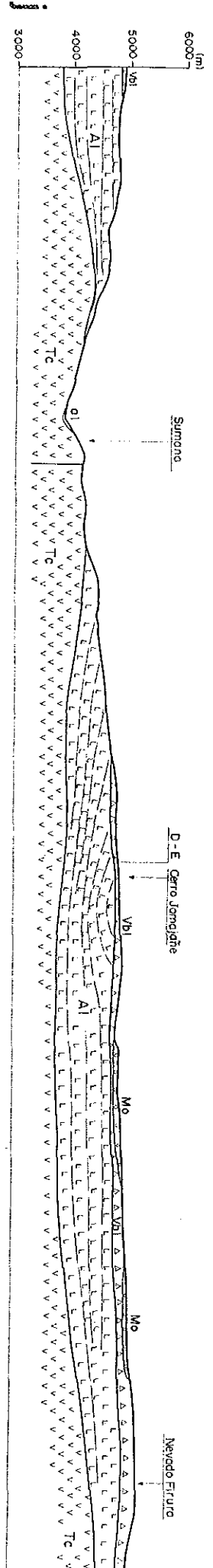
JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN
INSTITUTO GEOLOGICO MINERO Y METALURGICO
February 1986

Scale 1 : 50,000



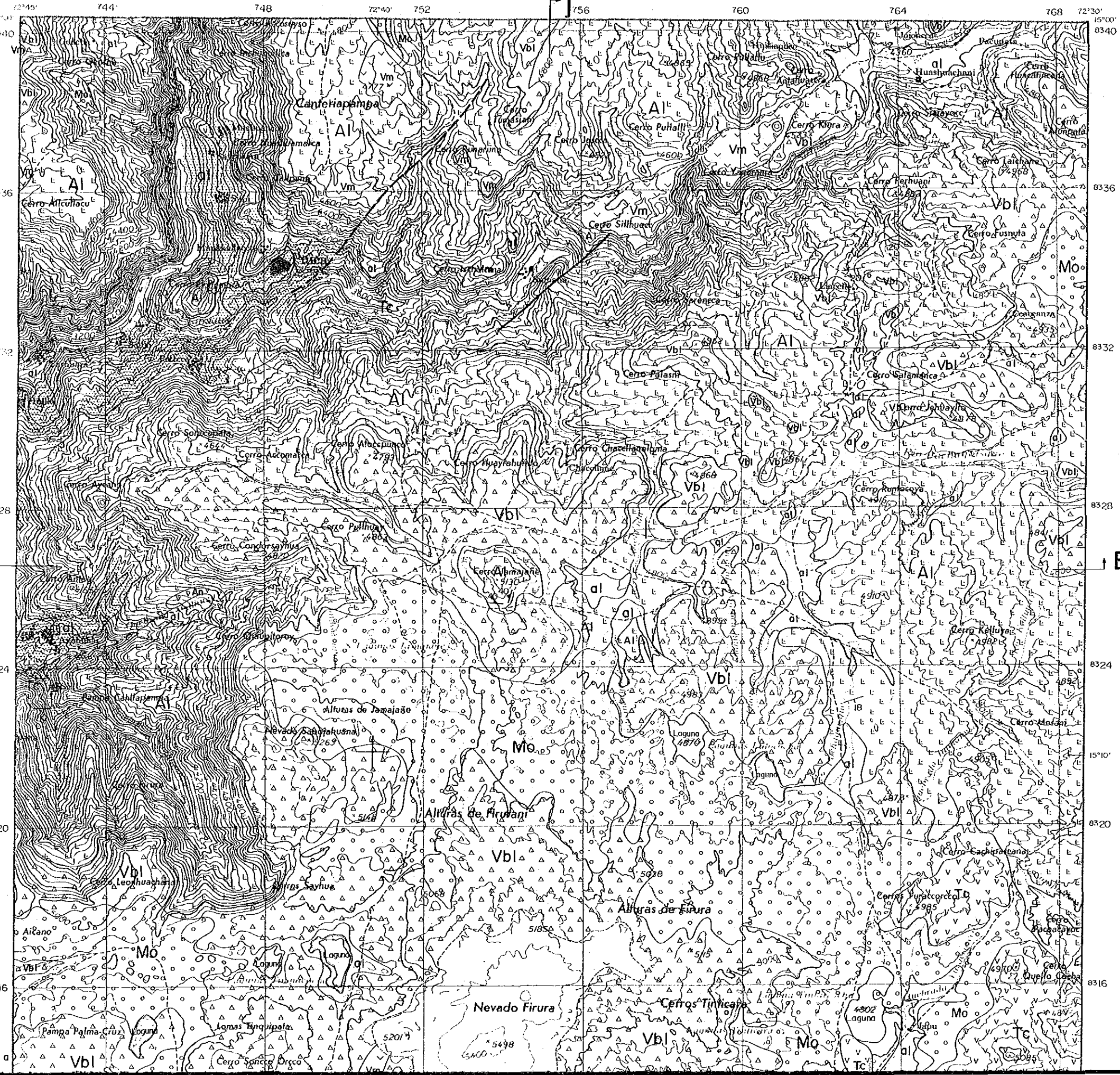
LEGEND

Cenozoic	Quaternary	Alluvium	al	Sand, mud and gravel	
		Holocene	Mollebamba Volcanic Rocks	Vm	Andesite lava and volcanic ash
			Volcanic Sediment of Pausa	o.v.vsp	Volcanic ash, sand and gravel
	Pleistocene	Lampa Volcanic Rocks	A.Vo	Andesite (basaltic), volcanic ash and gravel	
		Moraine Sediment	Mo	Gravel, sand and mud	
	Tertiary	Pliocene	Barroso Group	Upper: vbu, Lower: vbi	Acidic tuff and andesite lava and volcanic ash
			Sencca Volcanic Rocks	vsc	Hornblende-biotite welded tuff and tuff
		Miocene	Huayllillas Formation	Hy	Dacitic tuff (partly welded tuff)
	Mesozoic	Paleocene	Alpobamba Formation	Al	Dacitic tuff, lapilli and welded tuff (partly with dacite lava)
			Tacaza Formation	Tc	Andesitic tuff breccia and dacitic tuff breccia
		Cretaceous	Huancabamba Formation	Hc	Andesitic volcanic rocks and tuffaceous sands
			Acuruquina Formation	Ac	Limestone and marl and chert nodule
	Jurassic	Musco Formation	Mu	Red shale and sands bearing conglomerate	
		Yura Group	Yu	Quartzite, siliceous sand and alternation of quartzite	
		Socosan Formation	Sa	Black shale, limestone	
Precambrian	Choclate volcanic rocks	Cho	Andesitic tuff breccia, tuffaceous sandstone		
	Intrusive Rocks	Gn	Gneiss, gneissose granite		

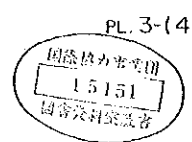


COTAHUASI

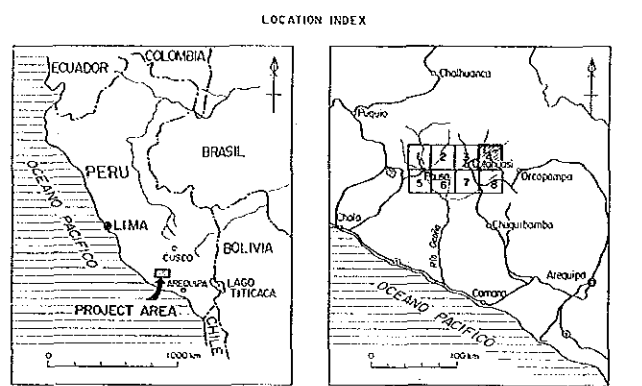
1	2	3	4
5	6	7	8



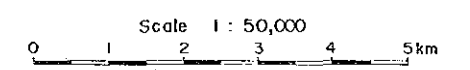
MINERAL EXPLORATION
IN
COTAHUASI AREA
(PHASE I)



GEOLOGICAL MAP OF THE REGIONAL SURVEY AREA (4)

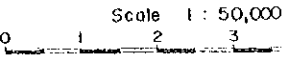


JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN
INSTITUTO GEOLOGICO MINERO Y METALURGICO
February 1986



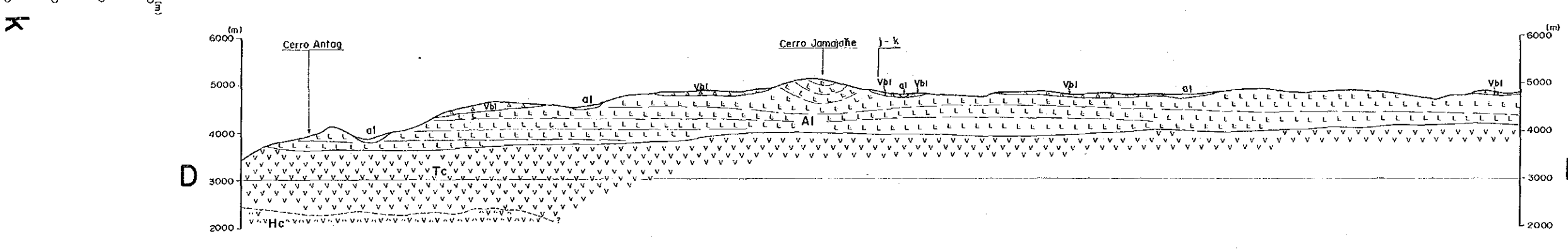
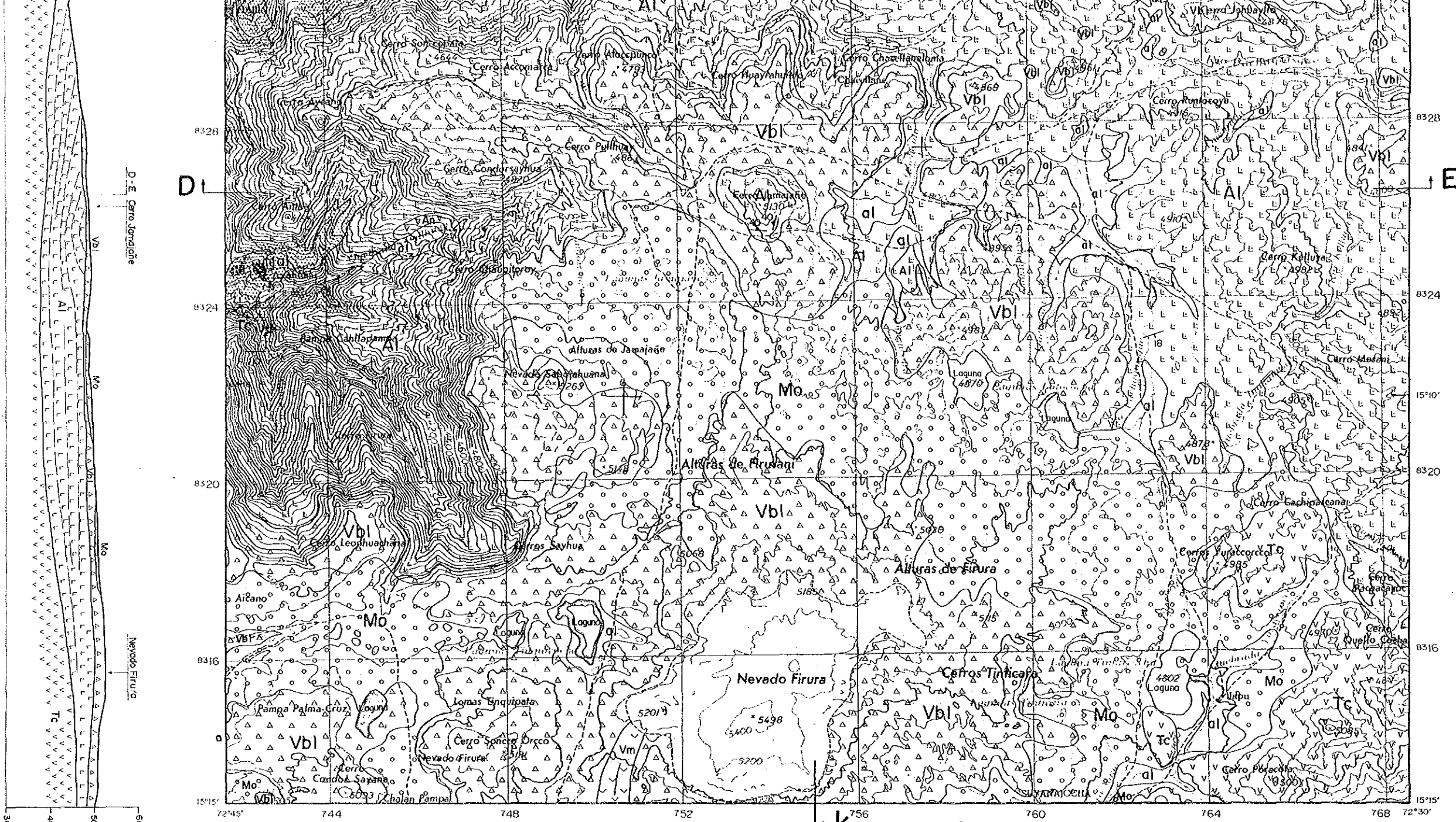
LEGEND

Cenozoic	Quaternary	Alluvium	ai	Sand, mud and gravel	
		Mollebamba Volcanic Rocks	vm	Andesite lava and volcanic ash	
		Volcanic Sediment of Pausa	vsp	Volcanic ash, sand and gravel	
		Lampa Volcanic Rocks	avl	Andesite (basaltic), volcanic breccia	
	Pleistocene	Moraine Sediment	mo	Gravel, sand and mud	
		Barroso Group	Upper	vbu	Acidic tuff
	Lower		vbl	Andesite lava and pyroclastic rocks	
	Tertiary	Pliocene	Sencca Volcanic Rocks	vsc	Hornblende-biotite dacite lava, welded tuff and tuff
			Huayllillas Formation	hy	Dacitic tuff (partly pumice bearing)
		Pliocene-Miocene	Alpabamba Formation	al	Dacitic tuff, lapilli tuff, tuff breccia and welded tuff (partly with dacite lava or andesite lava)
Tacaza Formation			tc	Andesitic tuff breccia, Andesite, tuff and dacitic tuff breccia (greenish grey)	
Huanco Formation			hc	Andesitic volcanic conglomerate, tuff breccia and tuffaceous sandstone (greenish grey)	
Mesozoic	Cretaceous	Arcuquina Formation	arc	Limestone and marl with sandstone and chert nodule	
		Murco Formation	mu	Red shale and sandstone with gypsum bearing conglomerate	
	Jurassic	Yura Group	yu	Quartzite, siliceous sandstone, black shale and alternation of quartzite and shale	
		Socosaní Formation	so	Black shale, limestone with sandstone and tuff	
		Chocolate volcanic rocks	cho	Andesitic tuff breccia, tuff, andesite and tuffaceous sandstone	
Precambrian	Gneiss	gn	Gneiss, gneissose granite and diorite		
Intrusive Rocks					

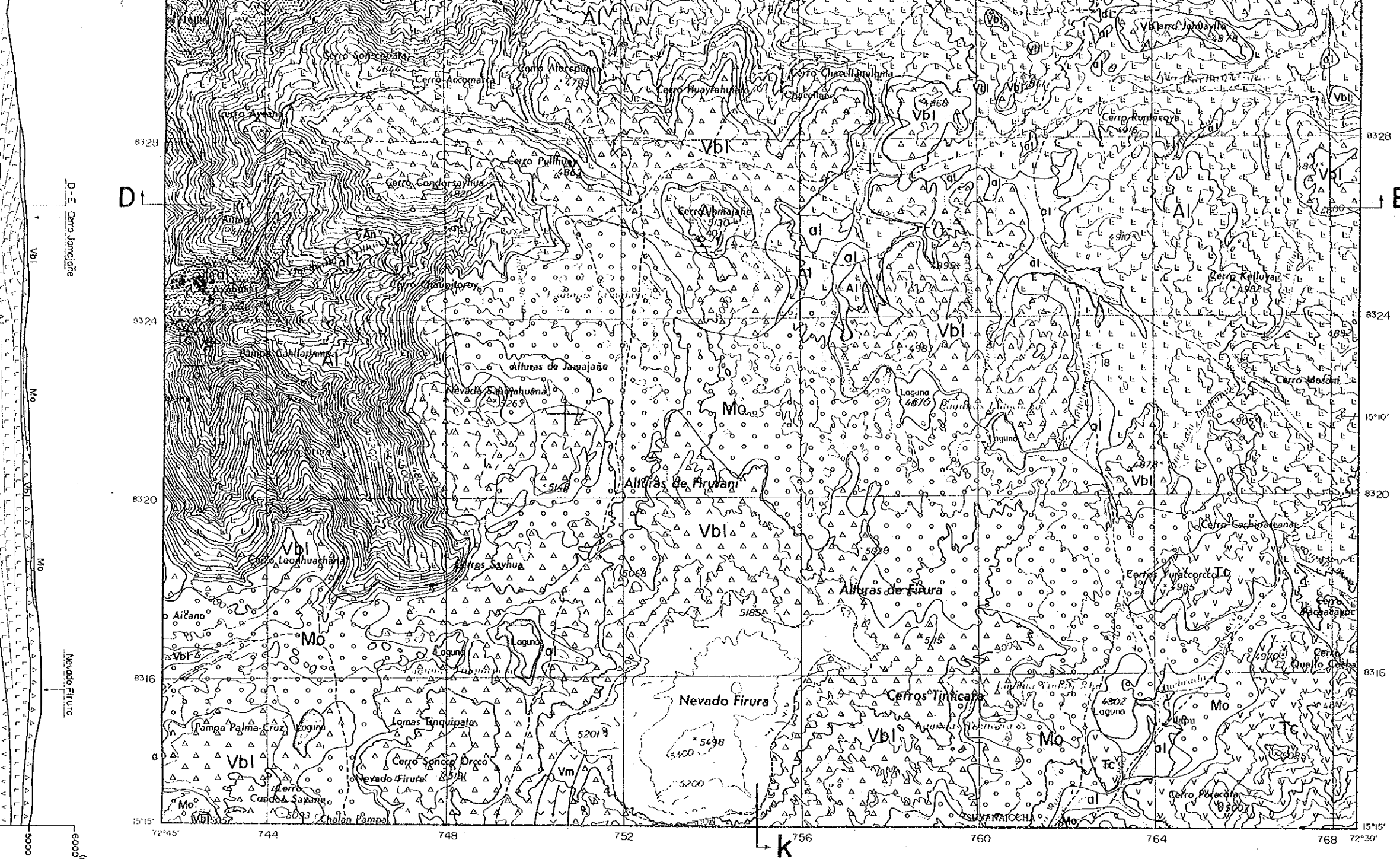
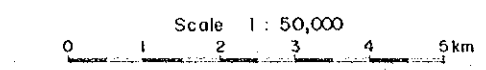


LEGEND

Cenozoic	Quaternary	Alluvium	al	Sand, mud a	
		Holocene	Mollebamba Volcanic Rocks	Vm	Andesite lava
			Volcanic Sediment of Pausa	o, o'vsp	Volcanic ash,
		Pleistocene	Lampa Volcanic Rocks	A, A'Vlo	Andesite (base
	Moraine Sediment		Mo	Gravel, sand	
	Tertiary	Pliocene	Borroso Group	Upper: Vb1, Lower: A'vbi	Acidic tuff Andesite lava
			Sencca Volcanic Rocks	Vse	Hornblende-bi welded tuff ar
		Miocene	Huayllillas Formation	Hy	Dacitic tuff (s
			Alpabamba Formation	Al	Dacitic tuff, ls and welded tu (partly with da
		Pliocene-Pleistocene	Tacaza Formation	Tc	Andesitic tuff and dacitic tuff
Huancra Formation			Hc	Andesitic volca and tuffaceous	
Mesozoic	Cretaceous	Arcurquina Formation	Arc	Limestone and and chert no	
		Murco Formation	Mu	Red shale and bearing conglor	
		Yura Group	Yu	Quartzite, siltic and alternation	
	Jurassic	Socosani Formation	So	Black shale, li	
		Chocolate volcanic rocks	Cho	Andesitic tuff & tuffaceous sand	
Precambrian		Gn	Gneiss, gneisso		
	Intrusive Rocks				
Tertiary	Stock and Dyke	Vv, Vv', An	Hornblende an		
	Accha Stock	X, X', Di	Diorite and qu		
Cretaceous	La Costa Batholith	CB	Quartz diorite		

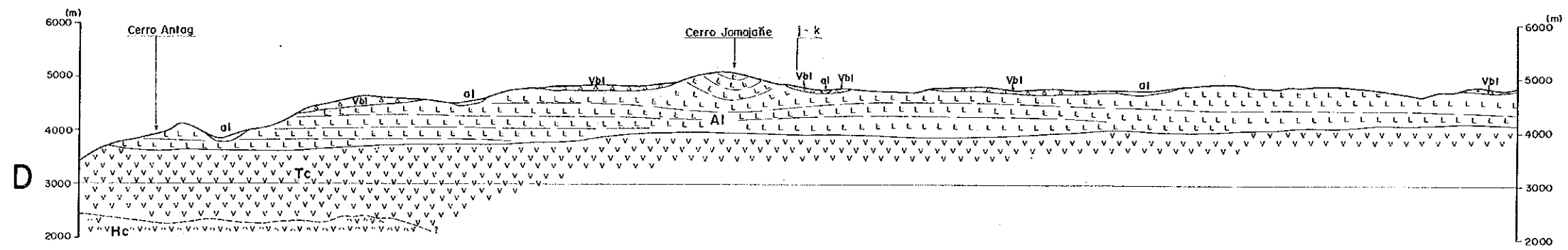


- Fault
- - - Inferred fault
- ∩ Anticline
- ∪ Syncline
- Geological boundary
- Geological projection
- ↘ Strike and dip
- ↙ Strike and dip
- ↗ Strike and dip
- X Mine (working)
- ⊕ Hot spring

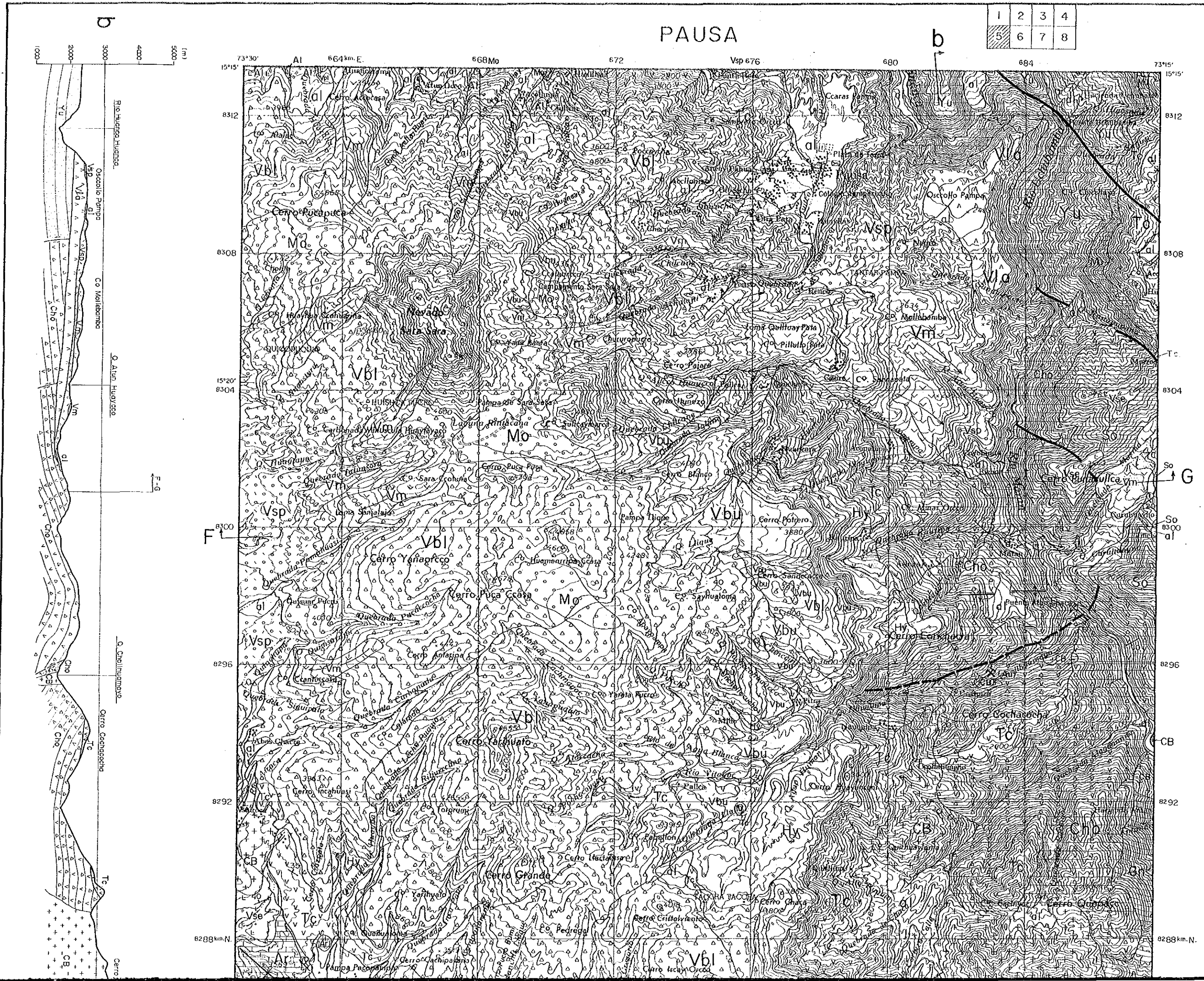


LEGEND

Cenozoic	Quaternary	Holocene	Alluvium	al	Sand, mud and gravel	
			Mollebamba Volcanic Rocks	Vm	Andesite lava and volcanic ash	
			Volcanic Sediment of Pausa	Vsp	Volcanic ash, sand and gravel	
	Pleistocene	Lampa	Volcanic Rocks	Vla	Andesite (basaltic), volcanic breccia	
			Moraine Sediment	Mo	Gravel, sand and mud	
	Tertiary	Pliocene	Barroso Group	Upper	Vbu	Acidic tuff
				Lower	Vbl	Andesite lava and pyroclastic rocks
		Miocene	Sencca Volcanic Rocks	Vse	Hornblende-biotite dacite lava, welded tuff and tuff	
			Huayllillas Formation	Vhy	Dacitic tuff (partly pumice bearing)	
			Alpabamba Formation	VAl	Dacitic tuff, lapilli tuff, tuff breccia and welded tuff (partly with dacite lava or andesite lava)	
Paleocene-Oligocene	Tacaza Formation	Vtc	Andesitic tuff breccia, Andesite, tuff and dacitic tuff breccia (greenish grey)			
	Huanca Formation	Vhc	Andesitic volcanic conglomerate, tuff breccia and tuffaceous sandstone (greenish grey)			
	Cretaceous	Arcuquina Formation	VAr	Limestone and marl with sandstone and chert nodule		
		Murco Formation	Vmu	Red shale and sandstone with gypsum bearing conglomerate		
Jurassic	Yura Group	Yura	Vyu	Quartzite, siliceous sandstone, black shale and alternation of quartzite and shale		
		Socosani Formation	Vso	Black shale, limestone with sandstone and tuff		
	Chocolate volcanic rocks	Vch	Andesitic tuff breccia, tuff, andesite and tuffaceous sandstone			
Precambrian				Gn	Gneiss, gneissose granite and diorite	
Tertiary	Intrusive Rocks	Stock and Dyke	VvAn	Hornblende andesite, andesite		
			VxDI	Diorite and quartz diorite		
		La Costa Batholith	V+CB	Quartz diorite and granodiorite		



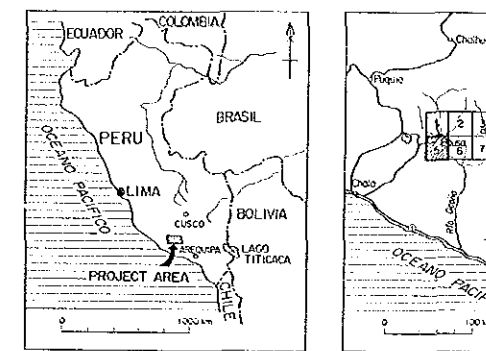
- Fault
- - - Inferred fault
- ∧ Anticline
- ∩ Syncline
- Geological boundary
- Geological profile line
- 30° Strike and dip of bedding
- 50° Strike and dip of foliation
- Strike and dip of flow structure
- X Mine (working or closed)
- ⊕ Hot spring



MINERAL EXPLORATION
IN
COTAHUASI AREA
(PHASE I)

GEOLOGICAL MAP THE REGIONAL SURVEY (5)

LOCATION INDEX



JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN
INSTITUTO GEOLOGICO MINERO Y METALURGICO
February 1986

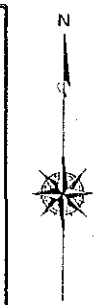
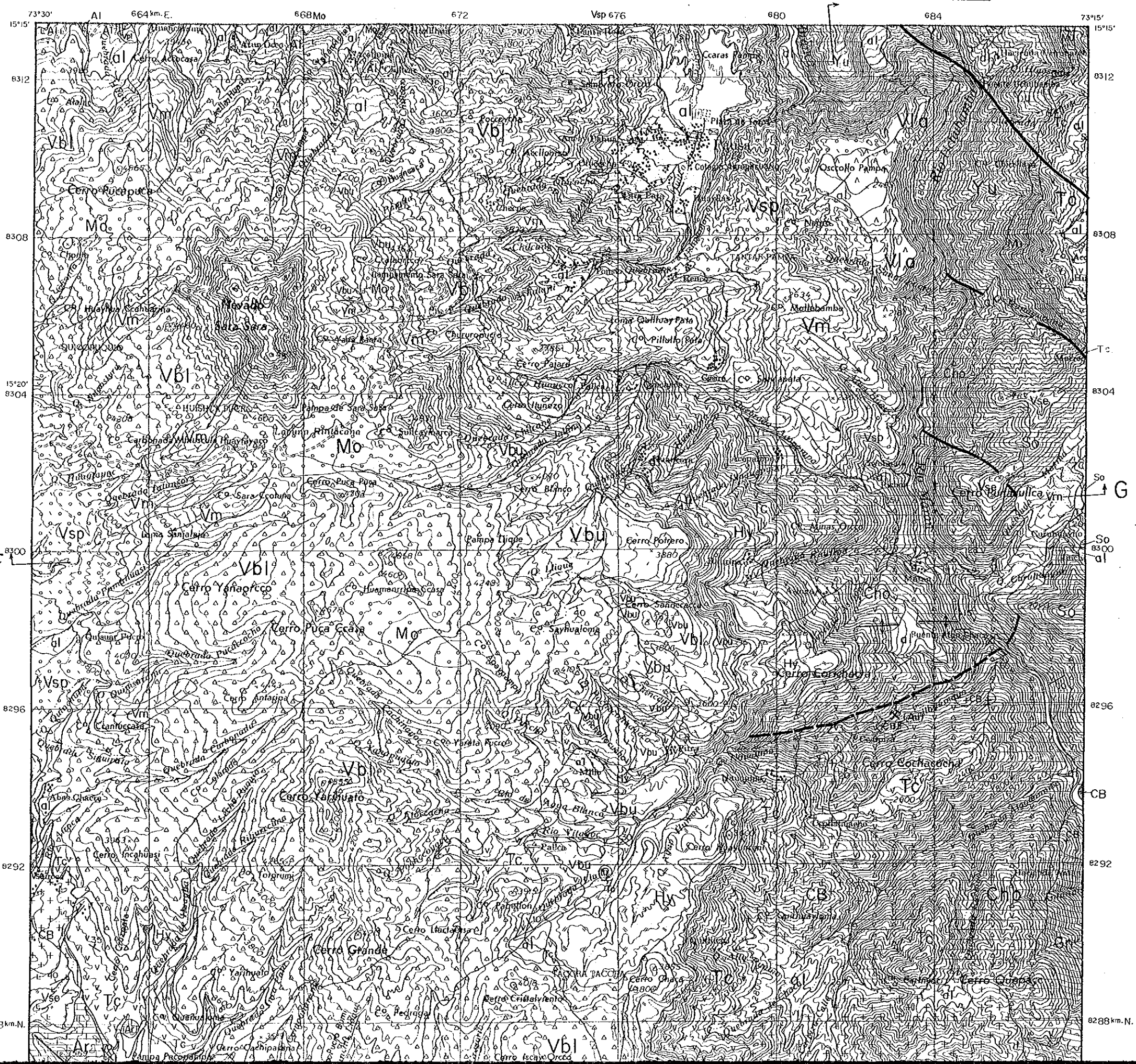
Scale 1 : 50,000

LEGEND

Quaternary	Holocene	Alluvium	al	Sand, mud and gravel	
		Mollebamba Volcanic Rocks	Vm	Andesite lava and volcano	
		Volcanic Sediment of Pausa	Vsp	Volcanic ash, sand and tuff	
		Lampa Volcanic Rocks	Vla	Andesite (basaltic), volcano	
	Pleistocene	Moraine Sediment	Mo	Gravel, sand and mud	
		Barrasa Group	Upper	Vbu	Acidic tuff
	Lower		Vbl	Andesite lava and pyroclastic	
	Pliocene	Sencca Volcanic Rocks	Sencca	Vse	Hornblende-biotite dacite welded tuff and tuff
			Huayllillas Formation	Vhy	Dacitic tuff (partly welded)
		Alpabamba Formation	Alpabamba	Vla	Dacitic tuff, lapilli tuff, and welded tuff (partly with dacite lava)
			Tacaza Formation	Vtc	Andesitic tuff breccia and dacitic tuff breccia
		Huanco Formation	Vhc	Andesitic volcanic congl. and tuffaceous sandstone	
Tertiary	Miocene	Arcurquina Formation	Varc	Limestone and marl with chert nodule	
		Murco Formation	Vmu	Red shale and sandstone bearing conglomerate	
	Oligocene	Yura Group	Vyu	Quartzite, siliceous sands and alternation of quartzite	
		Sacosani Formation	Vso	Black shale, limestone and tuffaceous sandstone	
Mesozoic	Jurassic	Chocolate volcanic rocks	Vcho	Andesitic tuff breccia, tuffaceous sandstone	
		Gneiss, gneissose granite	Vgn	Gneiss, gneissose granite	
Precambrian	Intrusive Rocks	Black and Dark	Vbd	Hornblende-biotite	
		Light	Vbl	Hornblende-biotite	

PAUSA

1	2	3	4
5	6	7	8



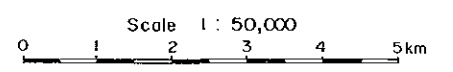
MINERAL EXPLORATION
IN
COTAHUASI AREA
(PHASE 1)

15151
同済資源調査

GEOLOGICAL MAP OF THE REGIONAL SURVEY AREA (5)

LOCATION INDEX

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN
INSTITUTO GEOLOGICO MINERO Y METALURGICO
February 1986



LEGEND

Cenozoic	Quaternary	Attivium	al	Sand, mud and gravel	
		Mollebamba Volcanic Rocks	Vm	Andesite lava and volcanic ash	
		Volcanic Sediment of Pausa	Vsp	Volcanic ash, sand and gravel	
	Pleistocene	Lampo Volcanic Rocks	Vla	Andesite (basaltic), volcanic breccia	
		Moraine Sediment	Mo	Gravel, sand and mud	
	Tertiary	Barroso Group	Upper	Vbu	Acidic tuff
			Lower	Vbl	Andesite lava and pyroclastic rocks
		Pliocene	Sencca Volcanic Rocks	Vse	Hornblende-biotite dacite lava, welded tuff and tuff
		Miocene	Huaytilas Formation	Vhy	Dacitic tuff (partly pumice bearing)
	Mesozoic	Cretaceous	Alpabamba Formation	Vla	Dacitic tuff, lapilli tuff, tuff breccia and welded tuff (partly with dacite lava or andesite lava)
			Tacaza Formation	Vtc	Andesitic tuff breccia, Andesite, tuff and dacitic tuff breccia (greenish grey)
		Jurassic	Huanca Formation	Vhc	Andesitic volcanic conglomerate, tuff breccia and tuffaceous sandstone (greenish grey)
			Arcurquina Formation	Vah	Limestone and marl with sandstone and chert nodule
Precambrian	Murco Formation	Vmu	Red shale and sandstone with gypsum bearing conglomerate		
	Yura Group	Vyu	Quartzite, siliceous sandstone, black shale and alternation of quartzite and shale		
	Soccosani Formation	Vso	Black shale, limestone with sandstone and tuff		
Intrusive Rocks	Chocolate volcanic rocks	Vcho	Andesitic tuff breccia, tuff, andesite and tuffaceous sandstone		
	Gneiss	Vgn	Gneiss, gneissose granite and diorite		

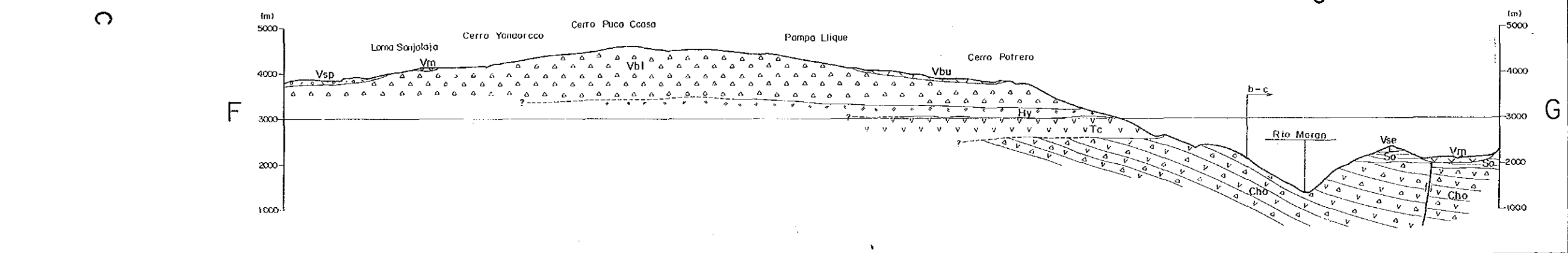
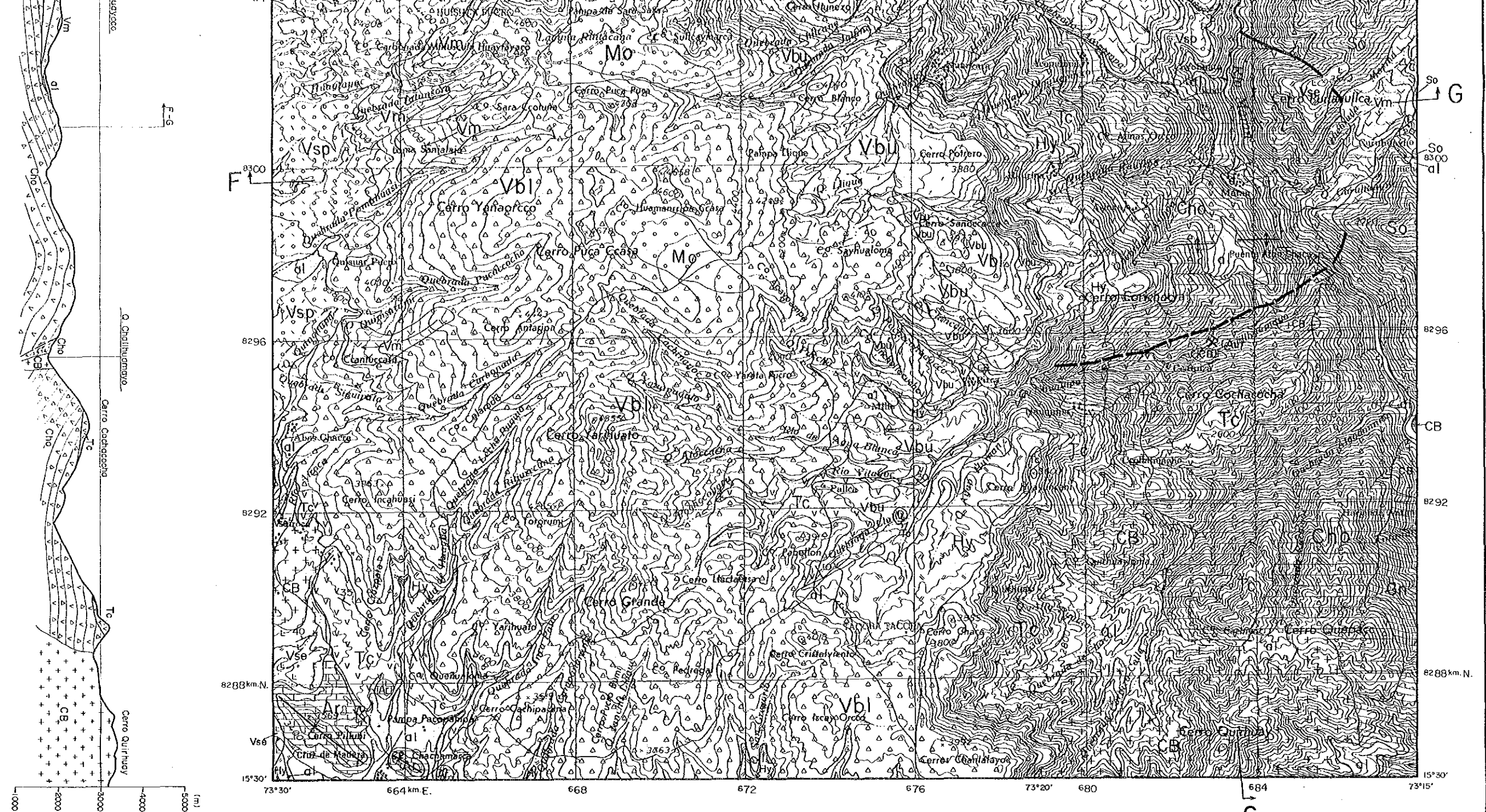
Scale 1 : 50,000

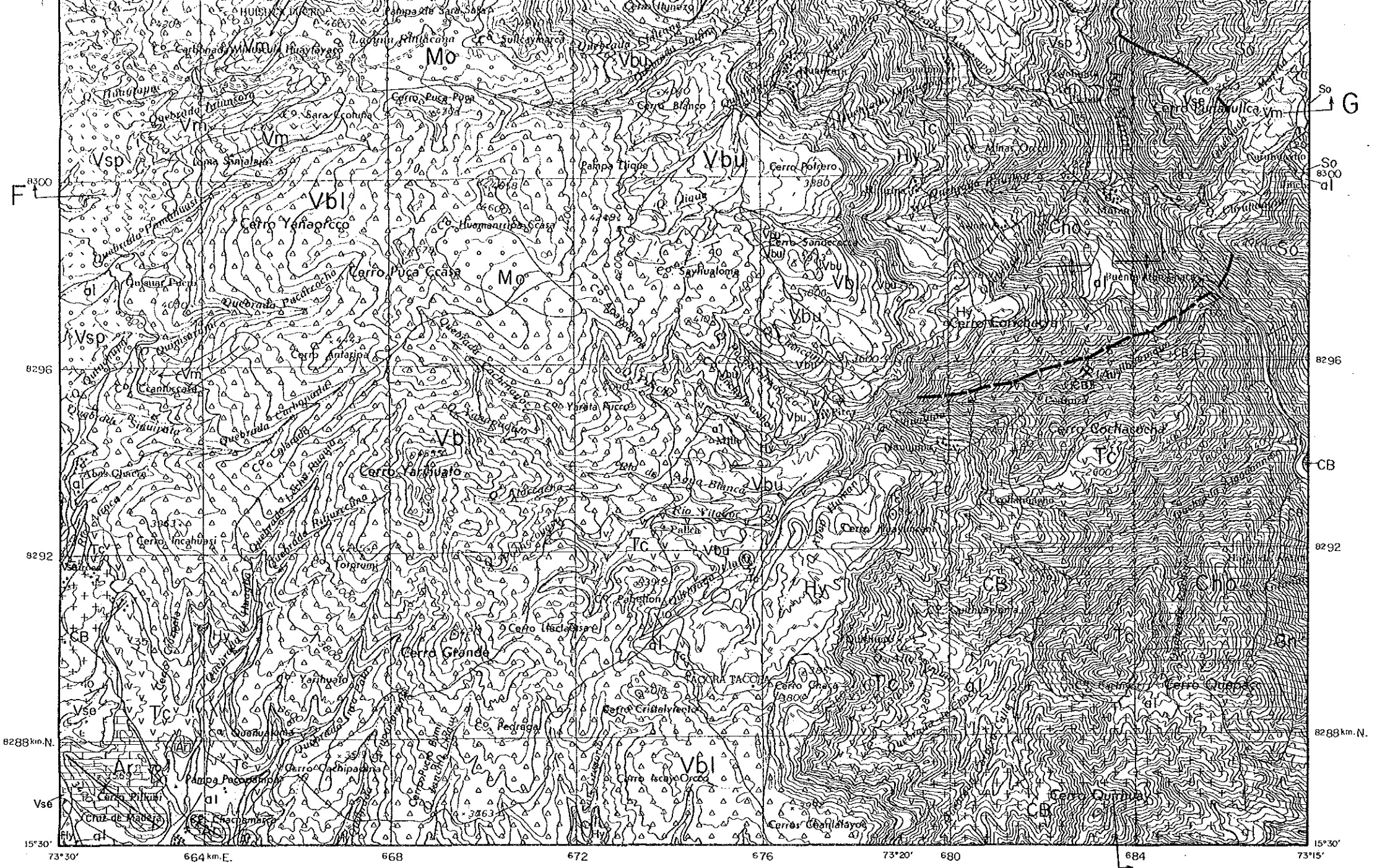
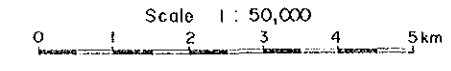
LEGEND

- Quaternary
 - Alluvium: Sand, mud and silt
 - Mollebamba Volcanic Rocks: Andesite lava and tuff
 - Volcanic Sediment of Pausa: Volcanic ash, sand and tuff
 - Lampa Volcanic Rocks: Andesite (basaltic)
- Cenozoic
 - Pleistocene
 - Moraine Sediment: Gravel, sand and silt
 - Barroso Group
 - Upper: Acidic tuff
 - Lower: Andesite lava and tuff
 - Tertiary
 - Pliocene
 - Sencca Volcanic Rocks: Hornblende-biotite welded tuff and tuffaceous sand
 - Huayllitas Formation: Dacitic tuff (partly welded)
 - Alpabamba Formation: Dacitic tuff, lapilli and welded tuff (partly with dacite)
 - Tacaza Formation: Andesitic tuff and dacitic tuff
 - Huanca Formation: Andesitic volcanic and tuffaceous sand
 - Cretaceous
 - Arcuquina Formation: Limestone and marl and chert nodules
 - Murco Formation: Red shale and siltstone bearing conglomerate
 - Yura Group: Quartzite, siliceous sandstone and tuffaceous sandstone
 - Socosani Formation: Black shale, limestone and chert nodules
 - Chocolate volcanic rocks: Andesitic tuff breccia and tuffaceous sands
- Precambrian
 - Gneiss, gneissose rocks

- Intrusive Rocks
 - Tertiary
 - Stock and Dyke: Hornblende andesite
 - Accha Stock: Diorite and quartzite
 - Cretaceous
 - La Costa Batholith: Quartz diorite and gabbro

- Fault
- Inferred fault
- Anticline
- Syncline
- Geological boundary
- Geological profile
- Strike and dip symbol (30°)
- Strike and dip symbol (50°)
- Strike and dip symbol (60°)
- Mine (working or abandoned)
- Hot spring

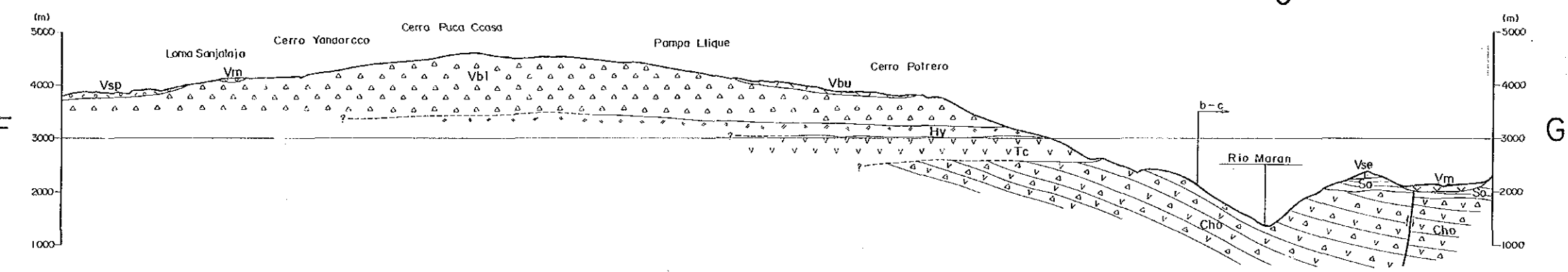




LEGEND

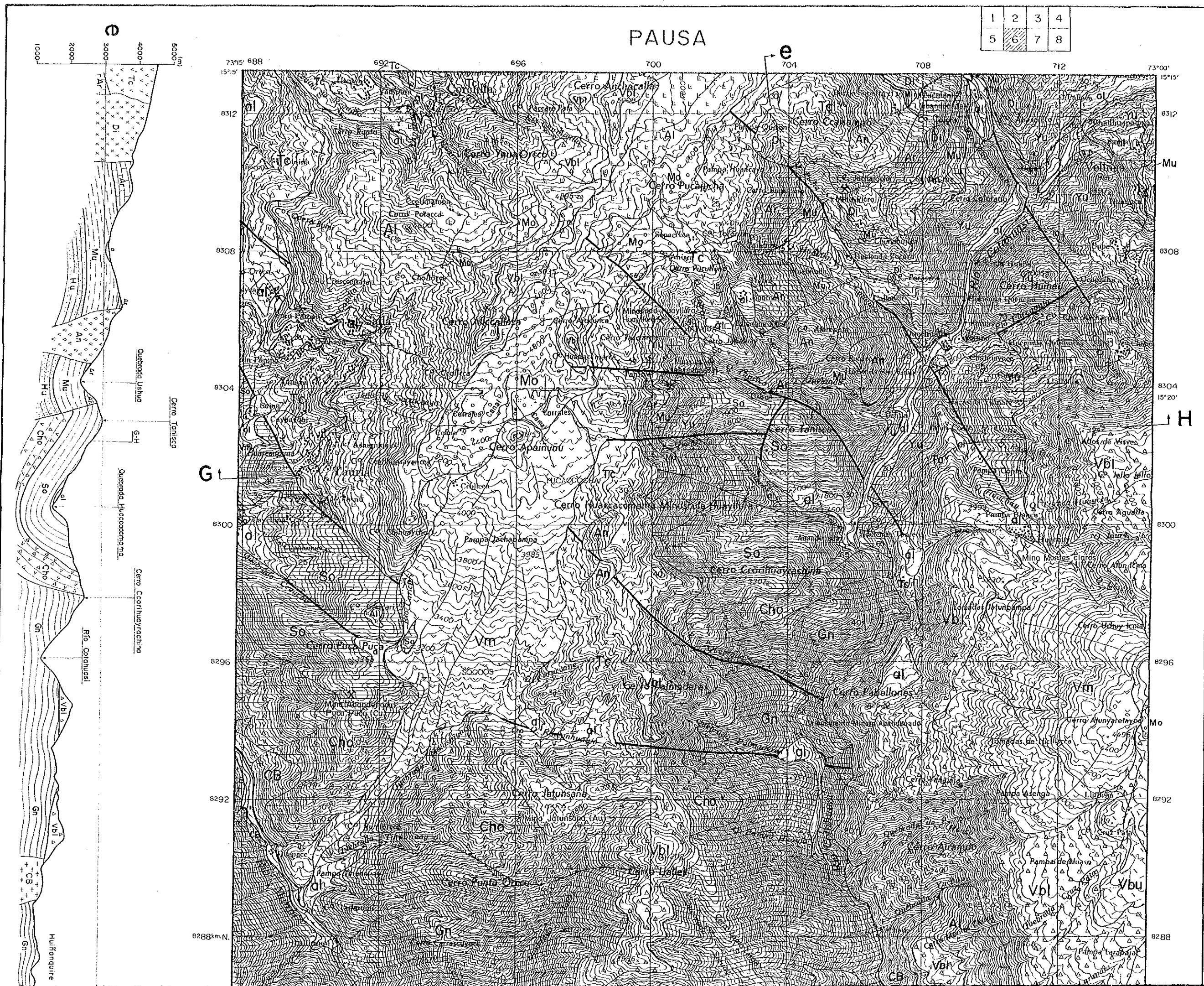
Cenozoic	Quaternary	Alluvium	al	Sand, mud and gravel	
		Mollebamba Volcanic Rocks	Vm	Andesite lava and volcanic ash	
		Volcanic Sediment of Pausa	Vsp	Volcanic ash, sand and gravel	
		Lampa Volcanic Rocks	Vla	Andesite (basaltic), volcanic breccia	
	Pleistocene	Moraine Sediment	Mo	Gravel, sand and mud	
		Barraso Group	Upper	Vbu	Acidic tuff
			Lower	Vbl	Andesite lava and pyroclastic rocks
		Pliocene	Seneca Volcanic Rocks	Vse	Hornblende-biotite dacite lava, welded tuff and tuff
			Huayllitas Formation	Hy	Dacitic tuff (partly pumice bearing)
		Tertiary	Miocene	Alpabamba Formation	Al
Tacaza Formation	Tc			Andesitic tuff breccia, Andesite, tuff and dacitic tuff breccia (greenish grey)	
Pliocene	Huanca Formation		Hc	Andesitic volcanic conglomerate, tuff breccia and tuffaceous sandstone (greenish grey)	
Mesozoic	Cretaceous	Arcuquina Formation	At	Limestone and marl with sandstone and chert nodules	
		Murco Formation	Mu	Red shale and sandstone with gypsum bearing conglomerate	
		Yura Group	Yu	Quartzite, siliceous sandstone, black shale and alternation of quartzite and shale	
	Jurassic	Socasani Formation	So	Black shale, limestone with sandstone and tuff	
		Chocolate volcanic rocks	Cho	Andesitic tuff breccia, tuff, andesite and tuffaceous sandstone	
Precambrian		Gn	Gneiss, gneissose granite and diorite		
Tertiary	Intrusive Rocks	Stock and Dyke	An	Hornblende andesite, andesite	
		Accha Stock	Di	Diorite and quartz diorite	
	Cretaceous	La Costa Batholith	CB	Quartz diorite and granodiorite	

—	Fault
- - -	Inferred fault
∩	Anticline
∪	Syncline
○	Geological boundary
— ^a — ^b	Geological profile line
30	Strike and dip of bedding
50	Strike and dip of foliation
↘	Strike and dip of flow structure
X	Mine (working or closed)
⊕	Hot spring



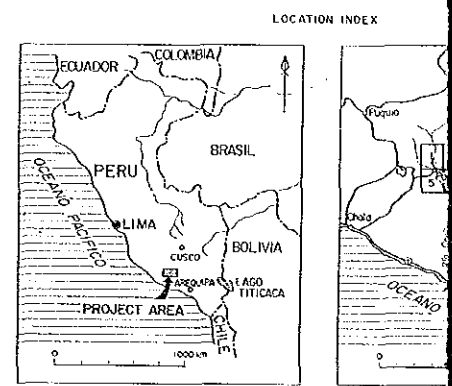
PAUSA

1	2	3	4
5	6	7	8



MINERAL EXPLORATION
IN
COTAHUASI AREA
(PHASE I)

GEOLOGICAL MAP THE REGIONAL SURVEY (6)

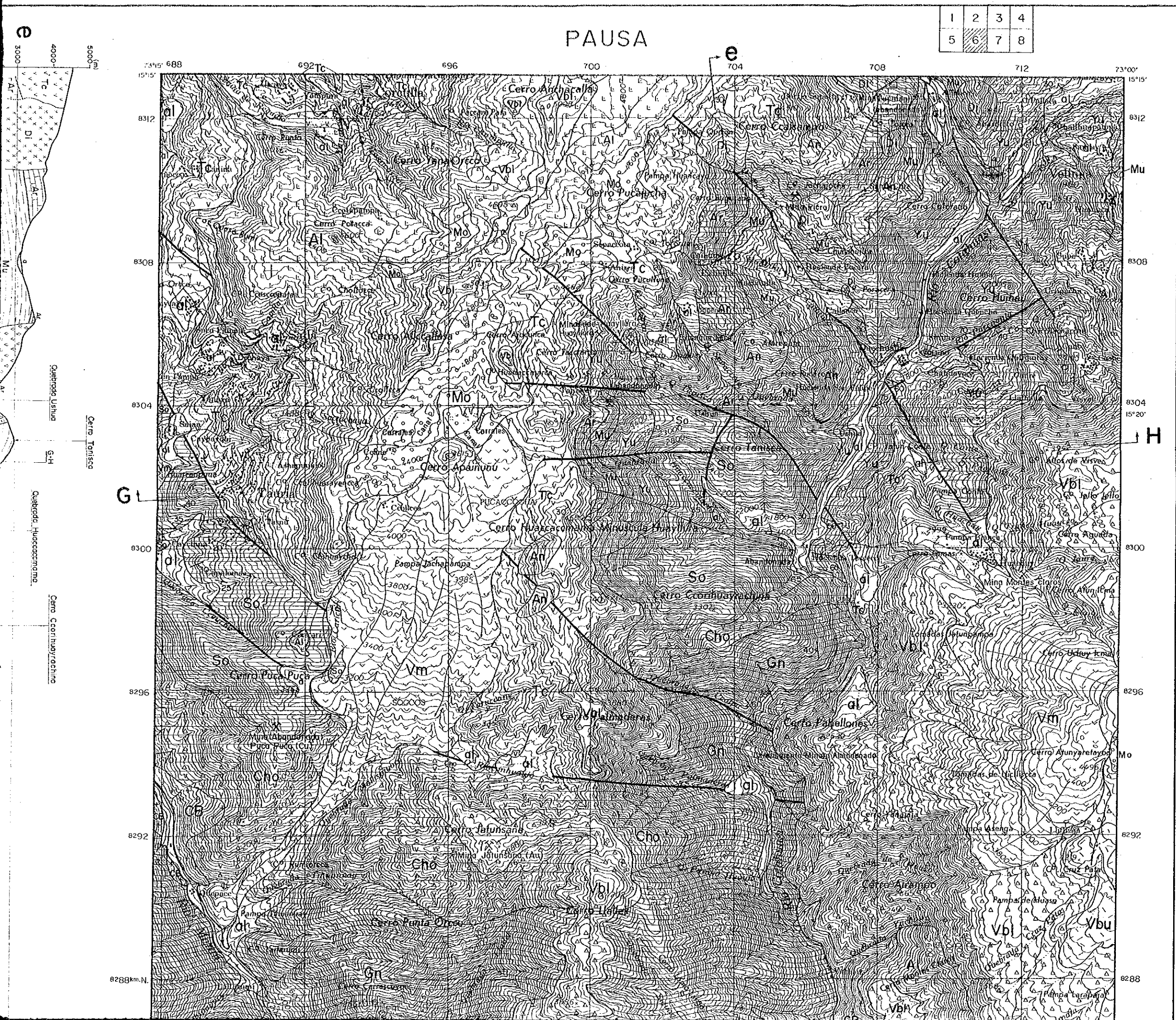


JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN
INSTITUTO GEOLOGICO MINERO Y METALURGICO
February 1986

Scale 1 : 50,000

LEGEND

Quaternary	Holocene	Alluvium	al	Sand, mud and gravel	
		Mollebamba Volcanic Rocks	vvm	Andesite lava and tuff	
		Volcanic Sediment of Pausa	vsp	Volcanic ash, sand and tuff	
	Lampo Volcanic Rocks	lvm	Andesite (basaltic), tuff		
		lva	Andesite (basaltic), tuff		
	Pleistocene	Moraine Sediment	mo	Gravel, sand and tuff	
		Borroso Group	Upper	vbu	Acidic tuff
	Lower		vbl	Andesite lava and tuff	
	Tertiary	Pliocene	Sencco Volcanic Rocks	sv	Hornblende-biotite welded tuff and tuff
			Huayllillas Formation	hy	Dacitic tuff (partly welded)
Miocene		Alpabamba Formation	alp	Dacitic tuff, lapilli and welded tuff (partly with dacite tuff)	
		Tacazo Formation	ta	Andesitic tuff breccia and dacitic tuff breccia	
Cretaceous	Paleocene	Huanca Formation	hu	Andesitic volcanic tuff and tuffaceous sandstone	
		Arcurquina Formation	arc	Limestone and marl and chert nodule	
	Cretaceous	Murco Formation	mu	Red shale and sandstone bearing conglomerate	
		Yura Group	yu	Quartzite, siliceous sandstone and alternation of quartzite and sandstone	
Jurassic	Sococani Formation	so	Black shale, limestone		
	Chocolate volcanic rocks	cho	Andesitic tuff breccia and tuffaceous sandstone		
Precambrian		Gn	Gneiss, gneissose gneiss		
Intrusive Rocks					
	Stock and Dyke	svd	Hornblende andesite		



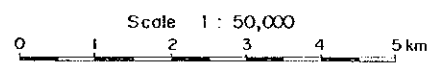
PL 3-(6)

MINERAL EXPLORATION
IN
COTAHUASI AREA
(PHASE 1)

GEOLOGICAL MAP OF
THE REGIONAL SURVEY AREA
(6)

LOCATION INDEX

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN /
INSTITUTO GEOLOGICO MINERO Y METALURGICO
February 1986



LEGEND

Cenozoic	Quaternary	Alluvium	al	Sand, mud and gravel	
		Mollebamba Volcanic Rocks	vm	Andesite lava and volcanic ash	
		Volcanic Sediment of Pausa	o o v sp	Volcanic ash, sand and gravel	
	Pleistocene	Lampa Volcanic Rocks	aa v la	Andesite (basaltic), volcanic breccia	
		Moraine Sediment	oo mo	Gravel, sand and mud	
			Barroso Group	Upper	Acidic tuff
	Lower	aa v bl		Andesite lava and pyroclastic rocks	
	Tertiary	Pliocene	Sencca Volcanic Rocks	l l v se	Hornblende-biotite dacite lava, welded tuff and tuff
			Huayllillas Formation	h h y	Dacitic tuff (partly pumice bearing)
		Miocene	Alpabamba Formation	l l a l	Dacitic tuff, lapilli tuff, tuff breccia and welded tuff (partly with dacite lava or andesite lava)
Tacaza Formation			v v t c	Andesitic tuff breccia, Andesite, tuff and dacitic tuff breccia (greenish grey)	
Huanca Formation			v v h c	Andesitic volcanic conglomerate, tuff breccia and tuffaceous sandstone (greenish grey)	
Mesozoic	Cretaceous	Arcurquina Formation	l l a r	Limestone and marl with sandstone and chert nodule	
		Murco Formation	l l m u	Red shale and sandstone with gypsum bearing conglomerate	
		Yura Group	l l y u	Quartzite, siliceous sandstone, black shale and alternation of quartzite and shale	
	Jurassic	Sucosani Formation	l l s o	Black shale, limestone with sandstone and tuff	
		Chocolate volcanic rocks	l l c h	Andesitic tuff breccia, tuff, andesite and tuffaceous sandstone	
Precambrian		Gn	Gneiss, gneissose granite and diorite		
Intrusive Rocks					
		Stock and Dyke	v v v	Hornblende andesite, andesite	

LEGEND

Cenozoic	Quaternary	Holocene	Alluvium	al	Sand, mud
		Pleistocene	Mollebamba Volcanic Rocks	Vm	Andesite tuff
			Volcanic Sediment of Pausa	Vp	Volcanic tuff
			Lampa Volcanic Rocks	Vlu	Andesite tuff
	Tertiary	Pliocene	Moraine Sediment	Mo	Gravel, sand
			Barroso Group	Upper	Vbu
		Lower		Vbl	Andesite
		Pleistocene	Sanca Volcanic Rocks	Vse	Hornblend welded tuff
			Huayllitas Formation	Vhy	Dacitic tuff
			Alpabamba Formation	Vai	Dacitic tuff and welded tuff (partly with andesite)
Tacaza Formation	Vtc		Andesitic and dacitic		
Mesozoic	Cretaceous	Huancá Formation	Vhc	Andesitic and tuffaceous	
		Arcurquina Formation	Var	Limestone and chert	
		Murco Formation	Mu	Red shale bearing coquina	
	Jurassic	Yura Group	Yu	Quartzite and altern.	
		Socosani Formation	So	Black shale	
		Chocolate volcanic rocks	Cho	Andesitic tuffaceous	
		Precambrian	Gneiss, gn	Gn	Gneiss, gn
	Tertiary	Intrusive Rocks	Stock and Dyke	Vv An	Hornblend
			Accha Stock	Vv DI	Diorite and gabbro
		Cretaceous	La Costa Batholith	Vv CB	Quartz diorite
<p>Geological Symbols:</p> <ul style="list-style-type: none"> Fault Inferred fault Anticline Syncline Geological contact Strike and thrust fault Strike and normal fault Strike and oblique fault Mine location Hot spring 					

