REPUBLIC OF PERU

REPORT ON GEOLOGICAL SURVEY OF THE CORDILLERA ORIENTAL, CENTRAL PERU

VOL. III

JULY 1976

METAL MINING AGENCY
JAPAN INTERNATIONAL COOPERATION AGENCY
GOVERNMENT OF JAPAN

PREFACE

The Government of Japan, in response to the request of the Government of the Republic of Peru, decided to conduct a geological survey for mineral exprolation in central part of Cordillera Oriental of Peru, and commissioned its implementation to the Japan International Cooperation Agency.

The Agency, taking into consideration of the importance of technical nature of the survey work, in turn sought the Metal Mining Agency of Japan for its cooperation to accomplish the task within a period of four years.

This year was for the second phase survey, and as for this current year, a survey team was formed consisting of Mr. Takashi Aoyama and Mr. Kunihiko Tsukanaka, Mitui Kinzoku Engineering Service Co., Ltd., and sent to the Republic of Peru on February 8, 1976. The team stayed there for twenty-two (22) days from Feburary 8, 1976 to Feburary 29, 1976. During the period of its stay, the team, in close collaboration with the Government of the Republic of Peru and its various authorities, was able to complete survey works on schedule. Aerial Photogrammetry was carried out based upon the results of the altitude survey by Mitui Kinzoku Engineering Service Co., Ltd., in Japan, as a result, Topographic Map was prepared at a scale of 1:25000.

This report submitted hereby summarizes the results and the process of the Altitude Survey and Aerial Photogrammetry performed for the second phase survey.

In wish to take this opportunity to express my heartfelt gratitude to the Government of the Republic of Peru and the other authorities concerned for their kind cooperation and support extended to the Japanese survey team.

July 1976

Shinsaku Hogen
President
Japan International Cooperation
Agency

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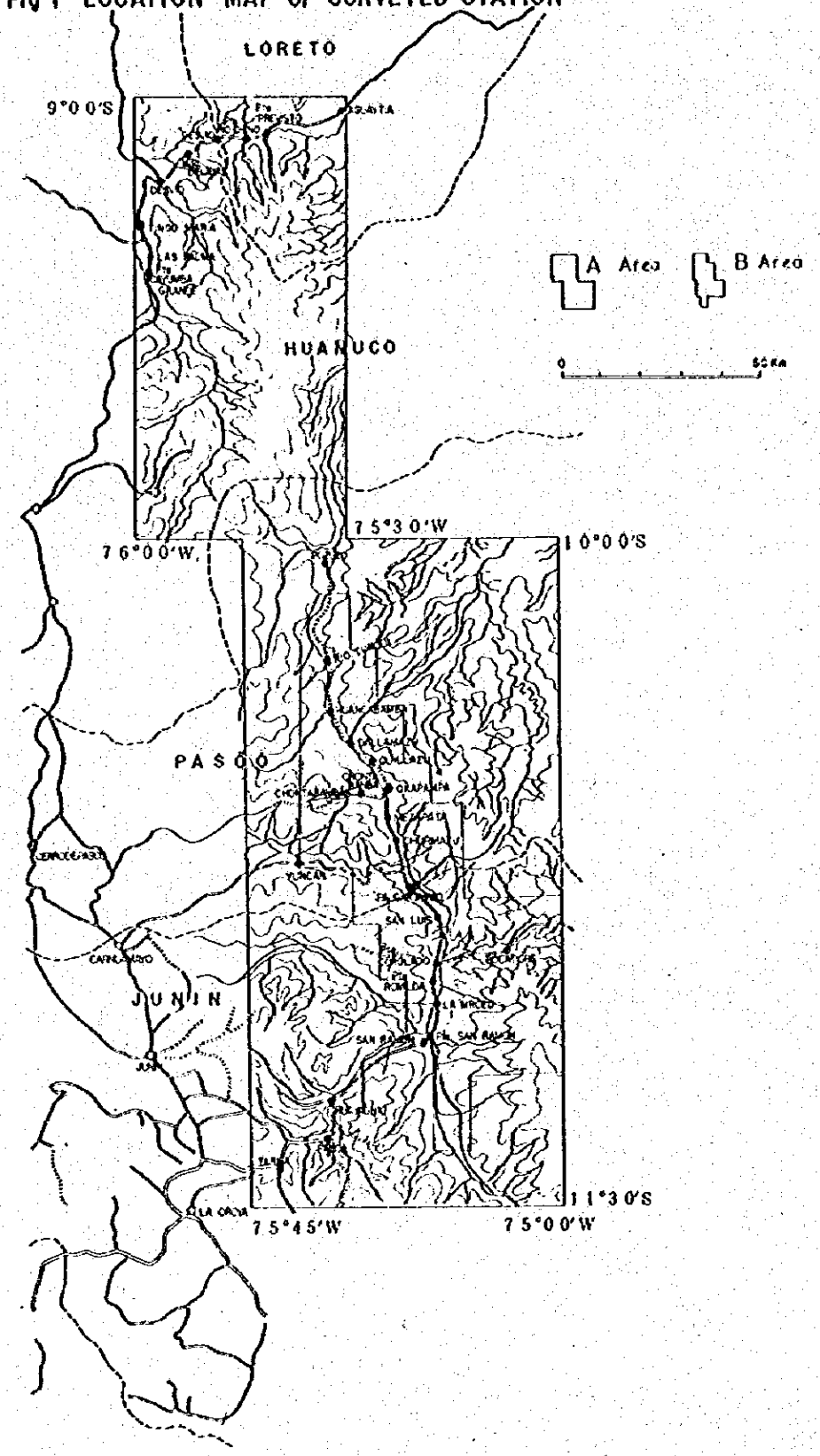


Chapter 1. Altitude Survey

1-1 Conditions of Survey

1-1-1 Location

The Areas cover a region full of topographic varieties, extending from the East Andes through inter-Andean basins and the Sub-Andes towards Amazonian low lands.

The region belongs to the administrative divisions of Departamento Junin in the south, Departamento Pasco in the north, and Departamento Loreto at a part of extreme north.

1-1-2 Accessibility

The traffic condition of the Areas is extremely doficient except the district of inter-Andean basins. Auto-roads are spread in the north of the region from Huanuco to Aguaytia via Tingo Maria, but the eastern slope has scarcely none of auto-road on account of its steep topography.

Many auto-roads are spread in the inter-Andean basins near San Ramon and Oxapampa, constructed for agricultural and forestry developments, but most of them are not so well maintained that become unpassable except a part time of dry season.

Present survey had to be carried out in the worst time of rainy season under the very changeable weather conditions, by which the road conditions were so bad as it required thrice of accessible time than in the ordinary condition of dry season.

1-1-3 Measuring Equipments

Name	MICRO SURVEYING ALTIMETER
Model	MM-1 (o m to + 5,000 m)
Dimension	Diam. 7", Ht. 3"7/8, Wt. 4 lbs (in a case)
Made in U.S.A. by	American Paulin System

1-2 Field Operations

Prior to the field operations, a publication "Description of Survey Stations" was purchased from Instituto Geografico Militar, in which the bench marks installed by the Peruvian government were described, and the closed surveys were practiced with 2 sets of Paulin's Micro Surveying Altimeter by taking any of the bench marks as datum.

The locations in the field were refred to the drainage maps of scale 1:100,000 made by Aero Service from the SLAR mosaics, and the topographic maps of scale 1:25,000 published by the Institure of Agricultural Land Improvements, the Republic of Peru. Moreover, enlarged aerial photos, enlarged about twice of the originals, of scale 1:12,000 approximately were used for the purpose of pin-pointing the positions of stations.

In handing the altimeters in the field practice of altitude survey, the following cares were taken.

(1) The altimeter and thermometer were kept away from the direct sun shine, so that their temperatures were kept equal to the atmospheric temperature.

(2) In order to maintain high accuracy, the pointer knob was rotated little by little to adjust the balance indicator needle to the balance mark.

(3) Temperature was kept constant whenever the equipments were carried over.

(4) The operations, were carried out avoiding the time zone when atmospheric pressure was changeable.

Cares were also taken to minimize the possible errors such as (1) reading errors, (2) personal errors, (3) errors in temperature adjustment, (4) errors caused by wind effects, and (5) drift errors between the altimeters.

The results of these cares made it possible to put all the reading errors by 2 sets of altimeter within 5 meters. A good example was obtained

that showed the difference within one meter between the measured altitude by the altimeter and the one obtained by levelling survey. This may tell fluently the accuracy of the measured altitude by the altimeter, which says:

a) The measured altitude by Paulin's Micro Surveying Altimeter was 527.42 m at the new Previst Bridge, which was located about 70 km from the B.M. of Tingo Maria.

b) The altitude of B.M. at the old Previst Bridge showed 524.954 m, which was obtained through the road levelling, now being carried out by the Peruvian government (cf. Fig. 30).

c) The old bridge is lower than the new, of which difference of elevations seems to be about 1.5 m.

Accordingly, the difference of the altitudes by a) and b) is approximetely one meter, which may be enough to expect a fairly good accuracy in Paulin's Micro Surveying Altimeter.

32 points including 7 vertical controls along the main road were surveyed by the Paulin's altimeters (cf. Fig. 1) of which results are shown on Table 1-1.

Table 1 - 1 Surveyed Altitude

Area	PLACE	ELEVATION	NOTES
		m	
	SAN RAMON	820.529	B.M. HUANUCO-TARMA-SANRAMON
	Pte. SAN RAMON	812.07	B.M. middle of the bridge
	LA MERCED	748.01	HUANUCO-TARMA-LAMERCED approach of the bridge
	Pte. ROMILDA	735.45	HUANUCO-TARMA-LAMERCED middle of the bridge
	Pte. COROLADO	689.11	JUNIN-TARMA-LA MERCED middle of the bridge
	BOCA TIGRE	582.40	JUNIN-TRAMA-BOCATIGRE
	SAN LUIS	725.40	JUNIN-TARMA-SANLUIS in front of the church
	Pte. PAUCARTAMBO	785.88	PASCO-SERRO DE PASCO-PAUCARTAMBO middle of the bridge
B	PAUCARTAMBO	789.08	PASCO-SERRO DE PASCO-PAUCARTAMBO middle of the bridge
	CHURMAZU	904.60	PASCO-OXAPAMPA-CHURMAZU
	MEZAPATA	1,135.60	PASCO-OXAPAMPA-MEZAPATA near the pass
	OXAPAMPA	1,813.54	B.M. PASCO-OXAPAMPA-OXAPAMPA
	CHONTABAMBA	1,832.08	PASCO-OXAPAMPA-CHONTABAMBA along the river
	CHONTABAMBA	1,823.68	PASCO-OXAPAMPA-CHONTABAMBA along the river
	QUILLAZU	1,808.49	PASCO-OXAPAMPA-QUILLAZU in front of the church
	PALLAMAZU	1,766.26	PASCO-OXAPAMPA-PALLAMAZU intersection of three roads
	HUANCABAMBA	1,747.16	PASCO-OXAPAMPA-HUANCABAMBA intersection of three roads

Area	PLACE	ELEVATION	NOTES
		m	
	RIO TUNQUI	1,420.40	PASCO-OXAPAMPA-SANPEDRO
	POZUZO	823.337	B.M.
	SAN RAMON	837. ± 5m	elevation from SATELLITE
	OXAPAMPA	1,814. ± 5m	PASCO-OXAPAMPA-OXAPAMPA elevation from SATELITE
A	HUAYAUGNIU	2,451.70	JUNIN-TARMA-PALCA
	PALCA	2,728.59	JUNIN-TARMA-PALCA
	TARMA	3,051.27	B.M. JUNIN-TARMA-TARMA
	JUNIN	4,107.10	B.M. JUNIN-JUNIN-JUNIN
	HUANUCO	1,900.00	HUANUCO-HUANUCO-HUANUCO
	UMARI	2,711.98	HUANUCO-PACHITEAPANAO-UMARI
	Pte. CAYUMBA GRANDE	779.45	HUANUCO-TINGOMARIA-LASPALMAS
	LAS PALMAS	722.46	HUANUCO-TINGOMARIA-LASPALMAS
	TINGO MARIA	652.45	HUANUCO-TINGOMARIA-TINGOMARIA
	DESVIO	659.59	intersection of three roads HUANUCO-TINGOMARIA-AUCAYACU
	Hda. DELICIAS	888.81	B.M. HUANUCO-TINGOMARIA-LEONCISPRADO
	DESVIO	1,688.88	HUANUCO-LEONCIO-HERMILIO-VALDIZAN
	Pte. RIO CHINO	1,126.96	LORETO-PADER-AGUAYTIA
	Pte. PREVISTO	527.42	LORETO-PADREABADO-AGUAYTIA
	Pte. AGUAYTIA	292.53	B.M. HUANUCO-TINGOMARIA-AGUAYTIA

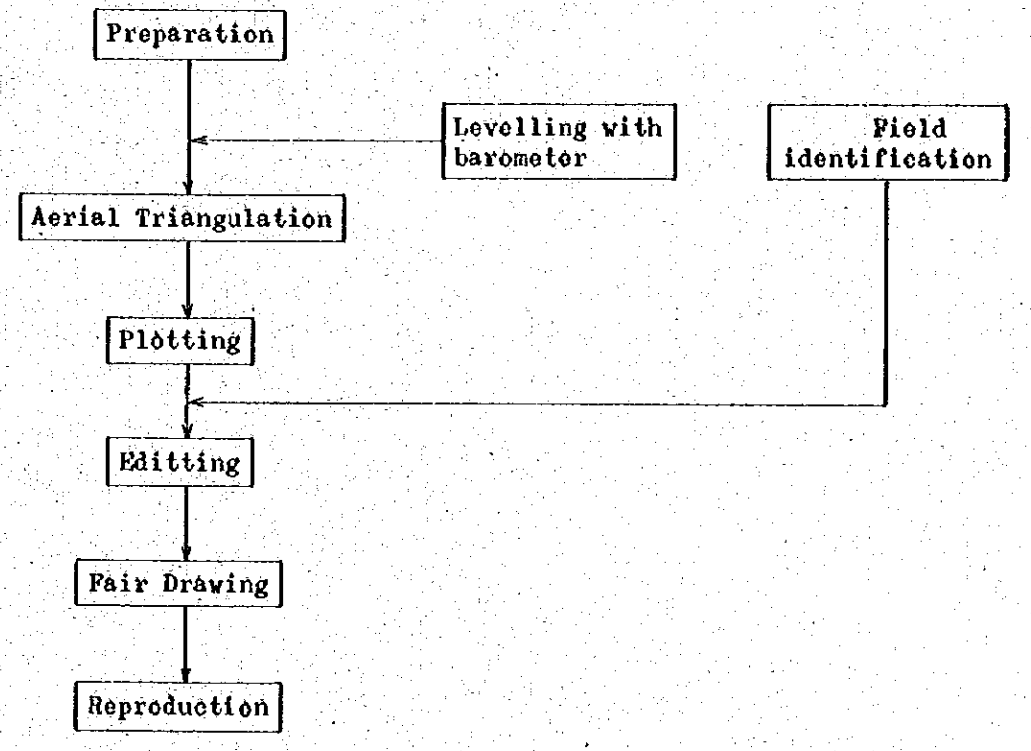
1-3 Organization of Survey Team

Engineers	Takashi AOYAMA
	Kunihiko TSUKANAKA
Labor	one
Vehicle	one
Period of survey	22 days from February 2 to 29, 1976

Chapter 2. Aerial Photogrammetry

2-1 Introduction

This work is to prepare 1/25,000 scale topographic base maps for geological and geochemical survey in the area shown on Fig. 32. The following working system was applied.



Details of working system and equipment will be described in each paragraph.

2-2 Preparation

This work involves (A) production of contact prints and positive films, (B) availability of existing maps, (C) identification of ground control points and (D) aquisition of cartographic specifications.

Generally, positive films have to be contact-printed from original

negative film. However, since military reasons prevented us from taking either negative or positive film out of Peru, contact prints had to be bought and brought in Japan. Positive films were printed after making negative film from contact paper prints with copying camera.

Flying data of aerial photographs are as follows;

Higher altitude photography (12 strips)

photographed on June and July, 1962

Fairchild KC series camera (wide angle)

photo scale from 1/37,000 to 1/50,000

Lower altitude photography (42 strips)

date of photography and aerial camera are unknown

wide angle camera is used

photo scale from 1/15,000 to 1/20,000

At present, original negative films are kept in safe at Servicio Aerofotographico Nacional (SAN) or Instituto Geografico Militar (IGM) in Peru.

Japanese-made large hanging type copying camera was used to make negative film.

Fig. 32 shows an area of existing 1/25,000 scale topographic map series.

2-3 Aerial Triangulation

Generally speaking, many conditions are necessary in applying photogrammetric technics to map production work using aerial photographs.

Some conditions are;

(1) overlap between successive photo has to be more than 60%

(2) sidelap between adjacent strips must be more than 20%

(3) at least, three ground control points per model have to be available

In order to satisfy condition (3), geodetic survey in the field has to be executed. However, it will be very costly and time consuming. Moreover, in many cases it is not possible to do it in jungle or swamp or steep mountaneous terrain. For this reason, another method except geodetic survey in the field has to be found out. Aerial triangulation is the most economical and effective solution to realise condition (3).

It is necessary to have at least three ground control points in the project area in order to perform aerial triangulation. In this project, since only one ground control point had to be picked up from the existing maps. Therefore, about 45 spot heights are selected from them and transferred and marked onto the high altitude photographs which covers the existing maps. As the reliability of those selected control points will surely affect to the reliability of new maps, the reliability of existing maps was checked by executing aerial triangulation in high altitude photography. However, since it was very hard to correspond topographic map and photographs because of steep terrain, and because spot heights are not always available where identification onto the photo is easily done, mean square errors at selected control points was about 30 meters in both planimetry and altimetry. Though this error seems to be too much, the reliability of existing maps is believed to be sufficient by considering the difficulties mentioned above.

Then, transformed coordinates of tie points, which were pre-selected in the common area between high and low altitude photography, were used as control points in low altitude photography which is used for map production. Fig. 33 shows photo index. It is obvious that partial flight, irregular direction of flight, lack of both over and sidelaps in a certain area, clouds prevention, sun spot and so on caused many difficulties. In this project, aerial triangulation was executed on 664 exposures (610 models).

In general, there are two ways in aerial triangulation, mechanical method and analytical method. Stereoplotter is used for mechanical method, and machine coordinates of unknown points on the optically restituted model in the stereoplotter are recorded and transformed into geodetic coordinates. On the other hand, comparator instead of stereoplotter is used for analytical method. Though machine coordinates are recorded, actual terrain is digitally restituted in the computer. Advantages of analytical method are high productivity and high accuracy because comparator gives approximately ten times higher accuracy performance than stereoplotter. Disadvantages of analytical method are that equipment investment is too much and that comparator can't be used as a multi-purpose instrument. In this project, analytical method was applied. Sokkisha-made stereo pricking device for point transfer and Zeiss Jana made Stecometer as comparator were used.

2-4 Plotting

By suing the results of aerial triangulation, 1/25,000 scale topographic maps were drawn with stereoplotters. Wild stereoplotter A-8, Wild autograph A-7 and Zeiss Planimat had been engaged in this work.

Sheet size was pre-determined at 7'30" by 7'30" in both longitude and latitude. Therefore, four corners of each sheet were coordinated by being transformed into U.T.M.#18 zone. Ground coordinates of pass point calculated by aerial triangulation were also plotted onto polyester base sheet.

Planimetric features and contour lines were drawn with stereoplotters after restituing optical model. Contour interval is 25 meters and index contour is 100 meters.

2-5 Editting and Fair Drawing

Editting means to complete original map for fair drawing by symbolising manuscript and by adding all informations collected in the field identification. In this project, due to steep terrain and limited field identification, not so many annotations appeared on the final maps. Cartographic specifications were determined through existing maps.

After superimposing another polyester base sheet on the editted sheet, all lines were fairly drawn by ink. Thus, fairly drawn sheets were completed.

Final map specification

scale : 1/25,000

contour interval : 25 meters

sheet size latitudinal interval : 7'30" (approximately 13.8 km)

longitudinal interval : 7'30" (approximately 13.7 km)

projection system : U.T.M. #18 zone

spheroid : international

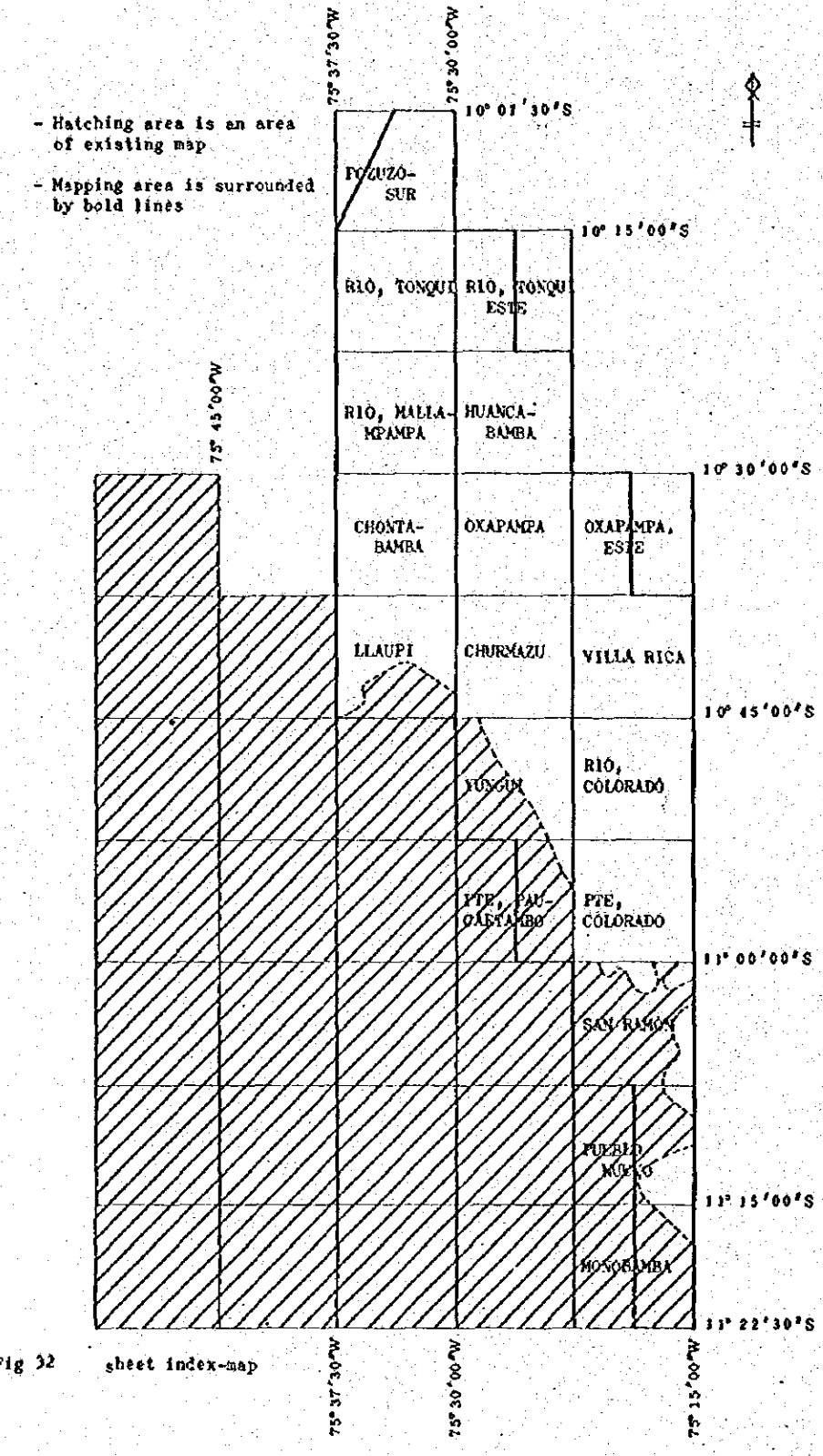


Fig 32 sheet index-map

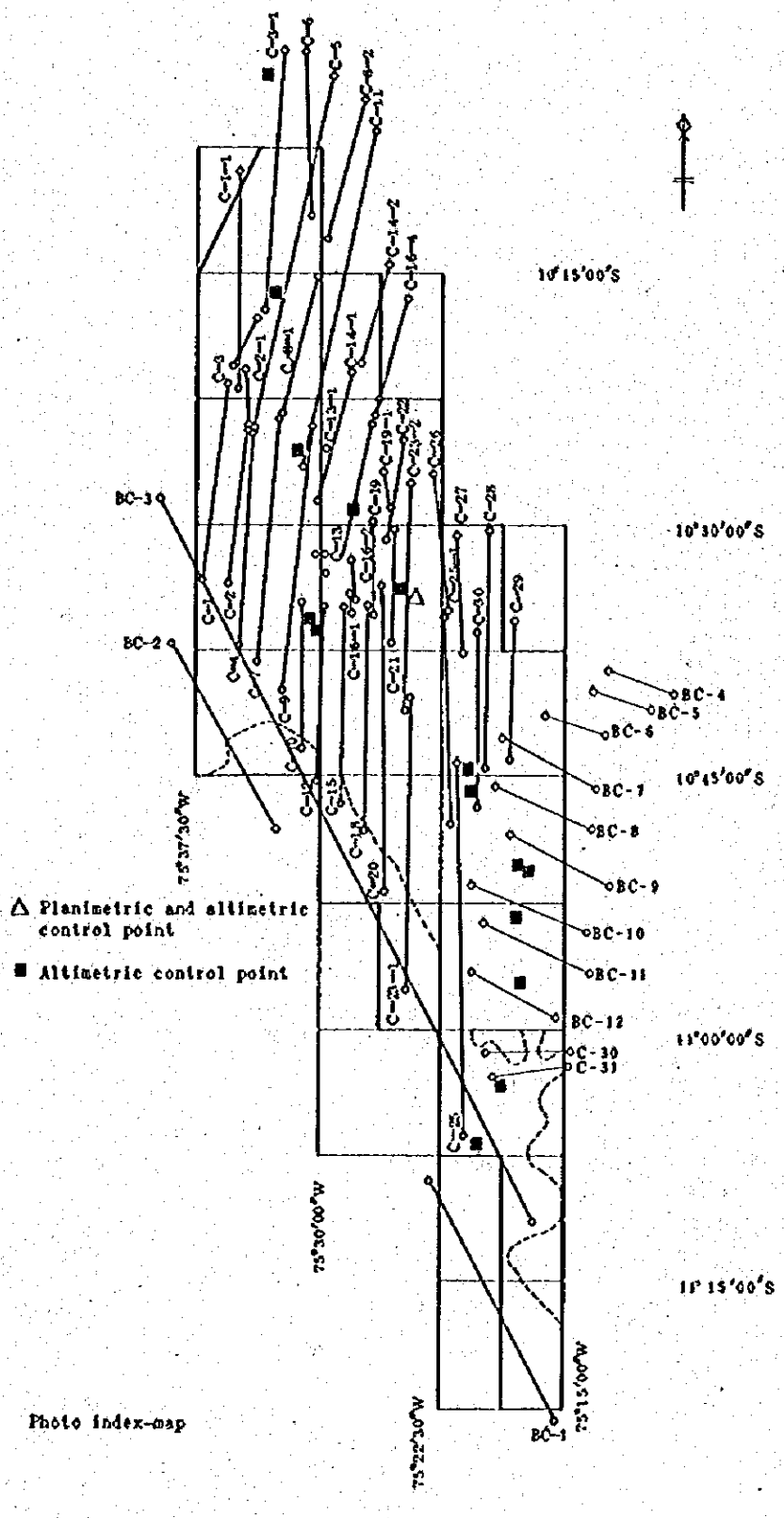


Fig 33 Photo index-map

APPENDICES

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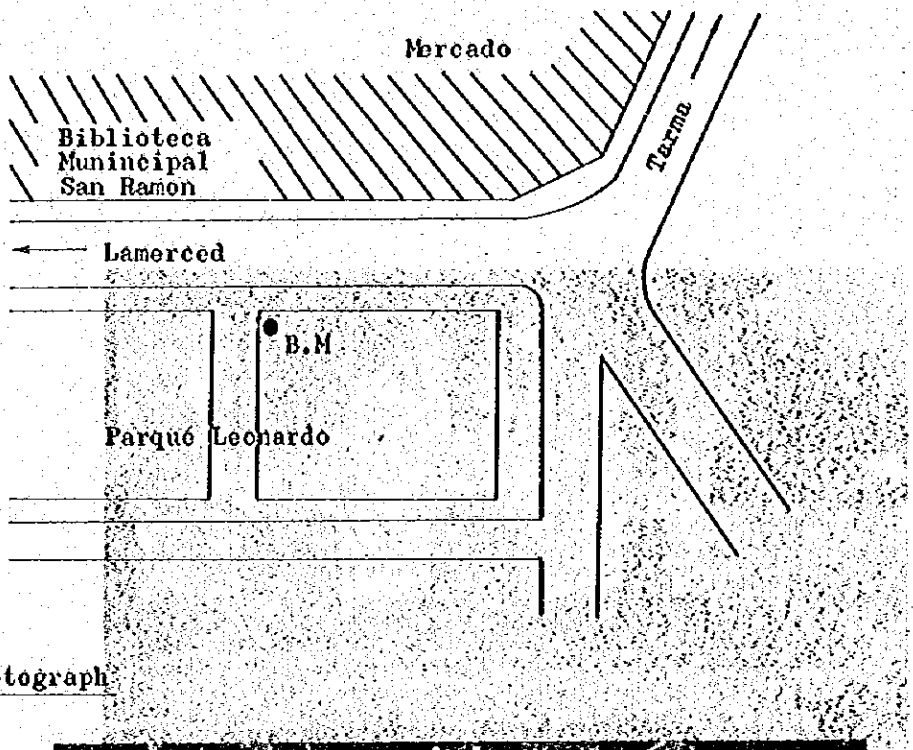
Fig. 2

ILLUSTRATION OF STATION

Location of station San Ramon Elevation H = 820.53m

Junin - Tarma - San Ramon

Illustration



Photograph

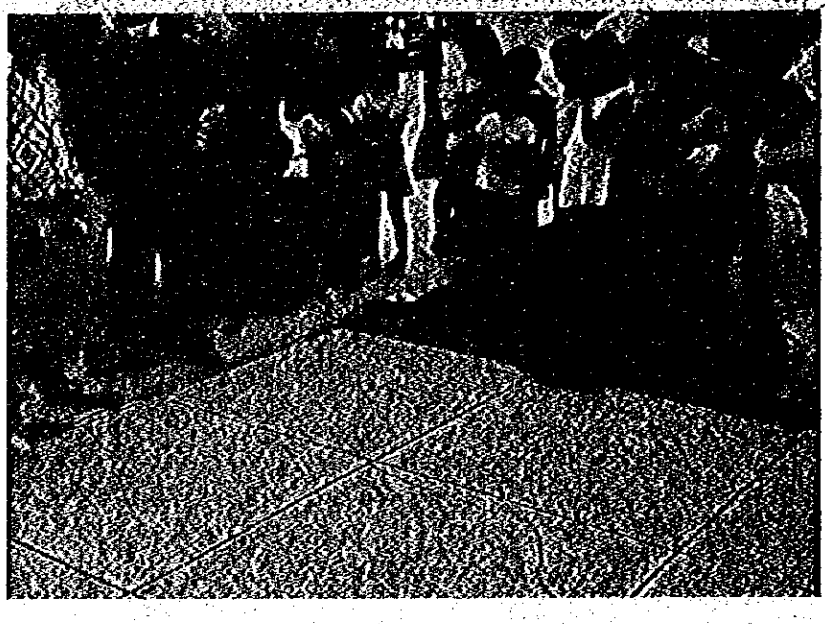


Fig. 2-A

COUNTRY PERU	TYPE OF MARK Monumento Disco de Bronce de 9 cms.	DESIGNATION OF MARK G 358
PROVINCE, STATE OR DEPARTMENT JUNIN	ESTABLISHED BY (AGENCY) I.G.M.	ELEVATION 820.5291 (FEET) (M)
MUNICIPALITY, COMMUNITY OR REGION	AGENCY (CAST IN MARK) S.G.I.A.	ORDER (FINAL) (PRELIM.)
LINE LA OROYA - OXAPAMPA	MARK IS STAMPED G 358 IGN 1959 PERU	DATUM

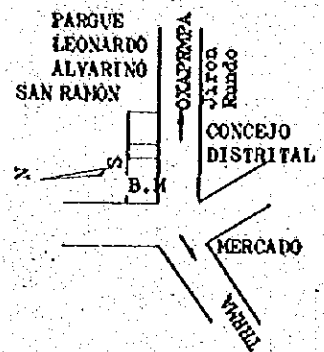
DESCRIPTION

A lo largo de la carretera Oroya-Oxapampa entre los pueblos de Tarma y San Ramón partiendo de la Plaza Alvarino de San Ramón el monumento está hacia el SE. a 0.0 Mi. situado sobre al Parque Alvarino. Está al costado NE. a 6.80 mts. del eje la carretera y a 0.20 mts. más alto del nivel del terreno que lo circunda.

Desde la puerta principal del Concejo Distrital con azimut magnético 25° está a 12.60 mts. desde la esquina NO. del concejo Distrital con azimut magnético 45° está a 14.90 mts. y desde la esquina NE. del mercado de abastos con azimut 70° está a 28.50 mts.

Desde la marca el eje de la carretera a 30 mts. al SE. está 0.0 mts. a 30 al O. está 0.0 mts. y frente a la marca 0.0 mts.

EL terreno alrededor es plano. La fotoidentificación



SETIEMBRE 1959

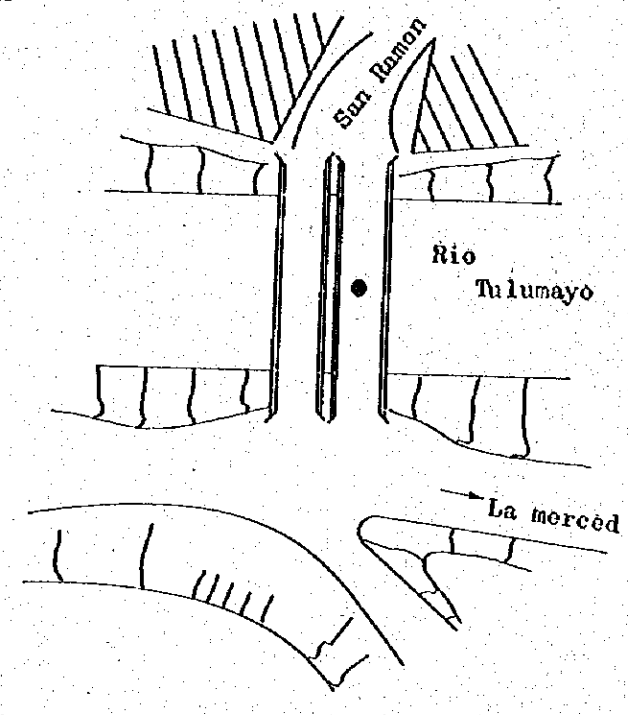
Fig. 2-B

ILLUSTRATION OF STATION

Location of station San Ramon Elevation H = 812.07 m

Junin-Tarma-San Ramon

Illustration



Photograph

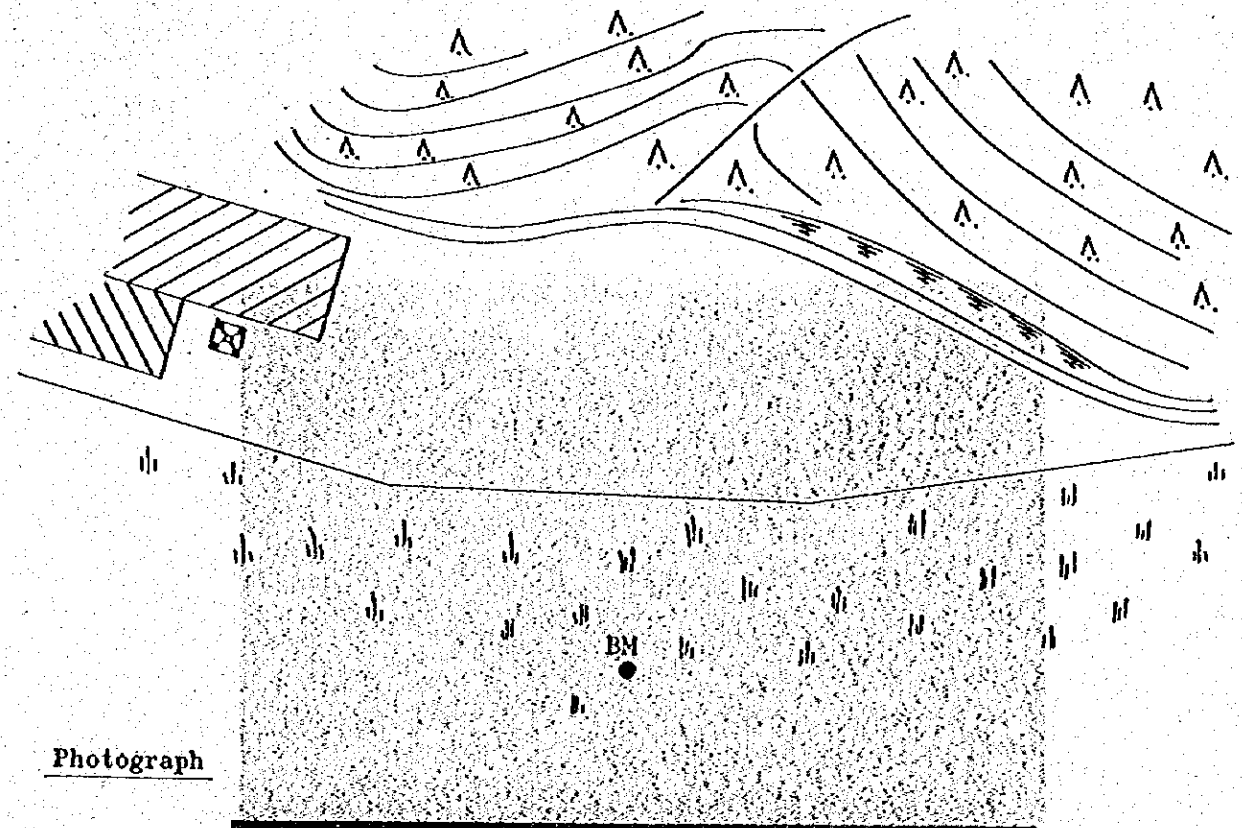
Fig. 2-C

ILLUSTRATION OF STATION

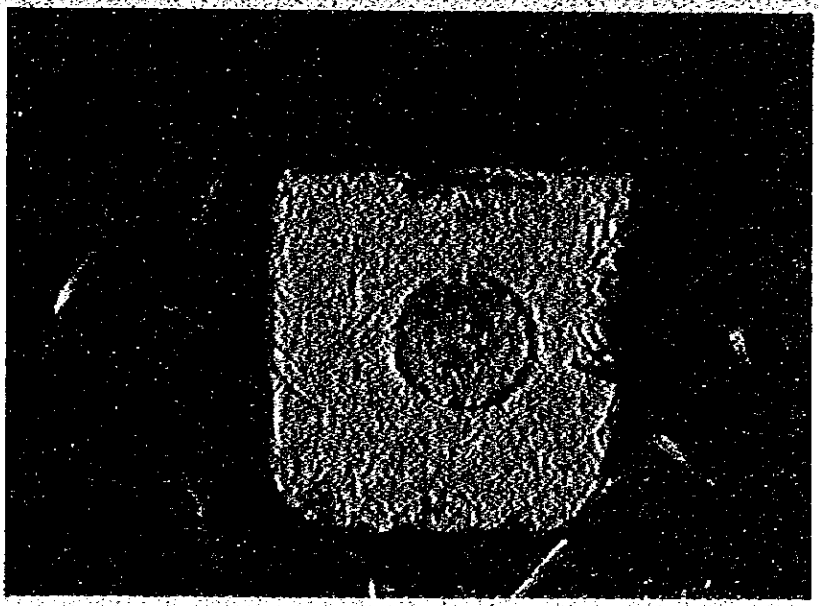
Location of station San Ramon Elevation H = 837.35 m

Junin-Tarma-San Ramon

Illustration



Photograph



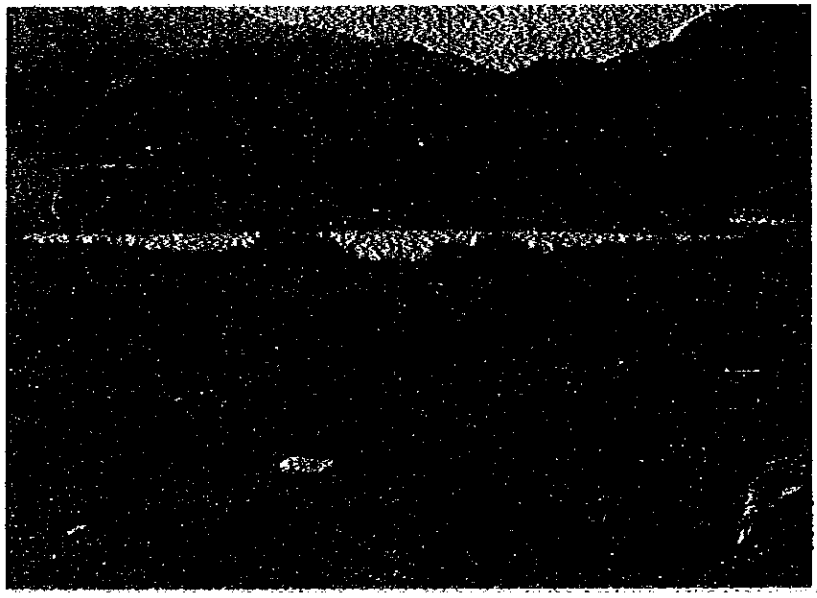


Fig. 2-D

GEODETIC SUMMARY
GEODETIC SATELLITE OBSERVATION STATION

LOCATION	EQUIPMENT	STATION NO.	OBSERVED BY (AGENCY)
San Ramon, Peru	Geoceiver	30343	DMATC

TRACKING EQUIPMENT REFERENCE POINT	PERIOD OF OCCUPATION
Electrical Center of Antenna	18 July - 21 July 74

TYPE OF STATION MARKER	AGENCY (CAST IN MARK)	STAMPING ON MARK
Dronze Disk	IAGS	SAN RAMON 1974 IGM

GEODETIC COCRDINATES (OF SATELLITE OBSN. STA.)		GRID COORDINATES (OF SATELLITE OBSN. STA.)			
LATITUDE ( ) '		NORTHING	EASTING	ZONE	GRID
S 11° 07' 20".525		8 770.452.8 (M)	461 078.3 (M)	18	UTM
LONGITUDE ( ) '		NORTHING (FT) (M)	EASTING (FT) (M)	ZONE	GRID
W 75° 21' 23".092					
DATUM 1956 Provisional South American Datum	ELLIPSOID International	TO OBTAIN GRID AZIMUTH, ADD TO THE GEODETIC AZIMUTH			
SURVEYED BY (AGENCY)		TO OBTAIN GRID AZ. (ADD) (SUB.) TO THE GEODETIC AZIMUTH			
LOCATION OF SURVEY DATA		ELEVATION ESTABLISHED BY (AGENCY)	DATE	ORDER	

ELEVATION OF MARK ABOVE MSL (GEOID)	HEIGHT OF GEOID ABOVE ELLIPSOID	HEIGHT OF TRACKING EQUIPMENT REF. PT. ABOVE STATION MARKER
837.	- 113.	1.658 METERS
HEIGHT OF REFERENCE POINT ABOVE ELLIPSOID	DATUM USED FOR GEOID HEIGHTS	PHOTOIDENTIFICATION BY AGENCY: WHERE FILED:
726.	PSAD 1956	

GEODETIC AZIMUTH
ASTRONOMIC (FROM SOUTH)

FROM	TO	AZIMUTH	DISTANCE

*Derived from Doppler satellite position transform = 281,885, = -106.277, and = 402.668 meters.

SKETCH OF STATION SITE AND VICINITY

SKETCH OF SURVEY (SHOW TIE TO LOCAL CONTROL)

The precision figures listed are for the geodetic coordinates refer to the datum as defined by established control in the area.

PREPARED BY (AGENCY)	DATE	REVISED BY (AGENCY)	DATE	REVISED BY (AGENCY)
DMATC	Jan 75			

Fig. 2-E

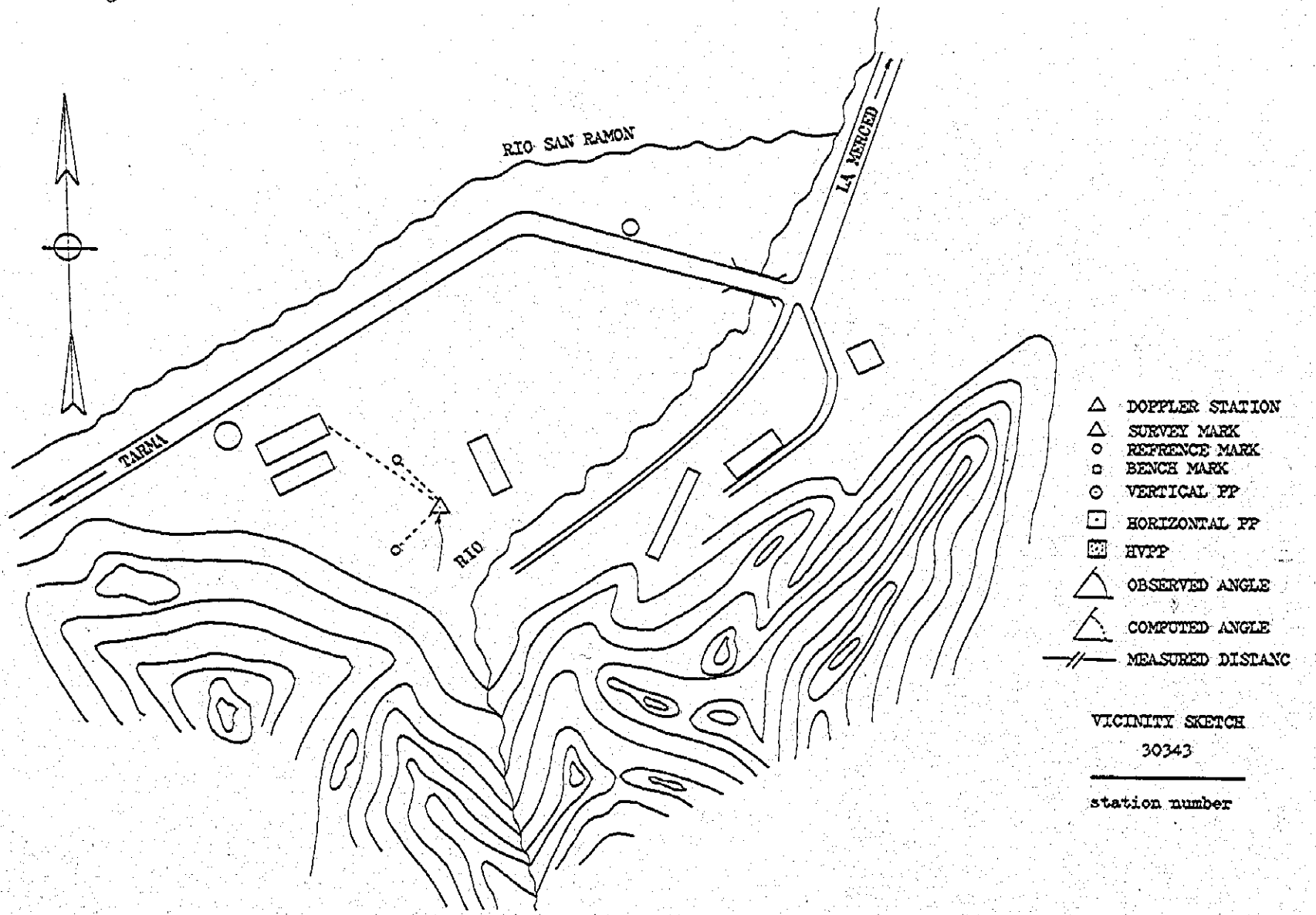

RIO SAN RAMON
LA MERCED
TARMA
RIO
DOPPLER STATION
SURVEY MARK
REFRENCE MARK
BENCH MARK
VERTICAL PP
HORIZONTAL PP
HVPP
OBSERVED ANGLE
COMPUTED ANGLE
MEASURED DISTANC
VICINITY SKETCH
30343
station number

Fig. 2-F

COUNTRY	TYPE OF MARK	STATION	
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION
LATITUDE	LONGITUDE	DATUM	DATUM
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE / ORDER

TO OBTAIN GRID AZIMUTH, ADD TO THE GEODETIC AZIMUTH

TO OBTAIN TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)

The station is located, 5Km sus from the town of San Ramón on the San Ramon school erounds.

Station marker is an IAGS type bronde disc embedded in a . 30x30 m 25 m above the surface and 85 m. deep concrete block It is 7.80 m from south corner of a summine pool being built, 61:50 from the east corner of the school on a magnetic azimuth of 120°. It is stamped : Gedc Est 30343-San Ramon. 1974-IEM.

RM 1 is an IAGS Type Bronee dist embedded in a 30 x 30 m, 25 m above the surface concrete block. It is a approsmately 12.00 m on a magnetic 0° 220° from the station.

RM2 same as above excect for a distance of 12.50 m and magnetic azimuth of 3130 from the station.

The azimuth marker is location on top of mountain approximately 1.5 Km and on a magnetic azimuth of 95° from the station.

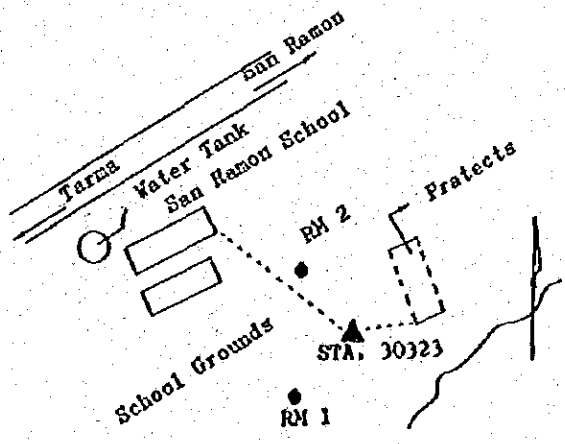


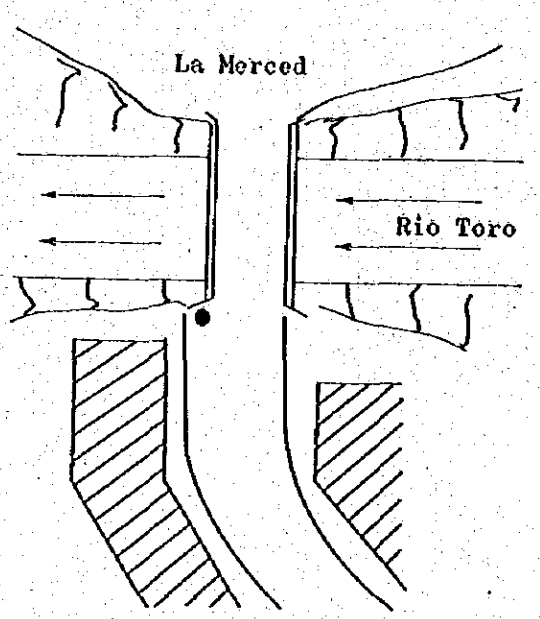
Fig. 3

ILLUSTRATION OF STATION

Location of station La Merced Elevation H = 748.01 m

Junin-Tarma-La Merced

Illustration



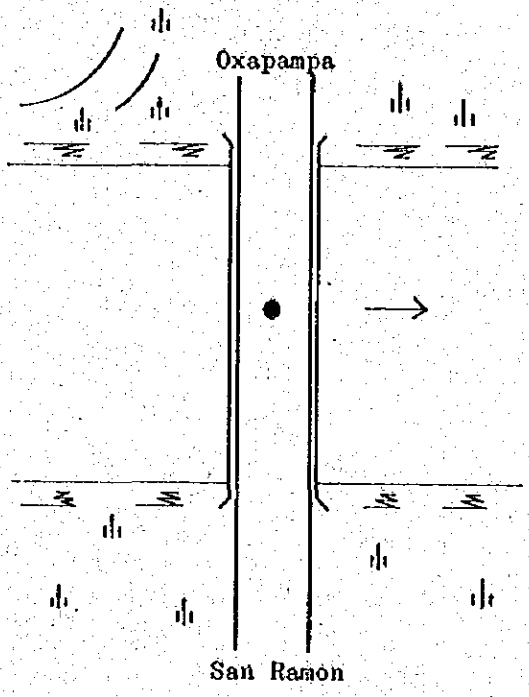
Photograph

Fig. 4 ILLUSTRATION OF STATION

Location of station Pte. Romilda Elevation H = 735.45 m

Junin - Tarma - La Merced

Illustration



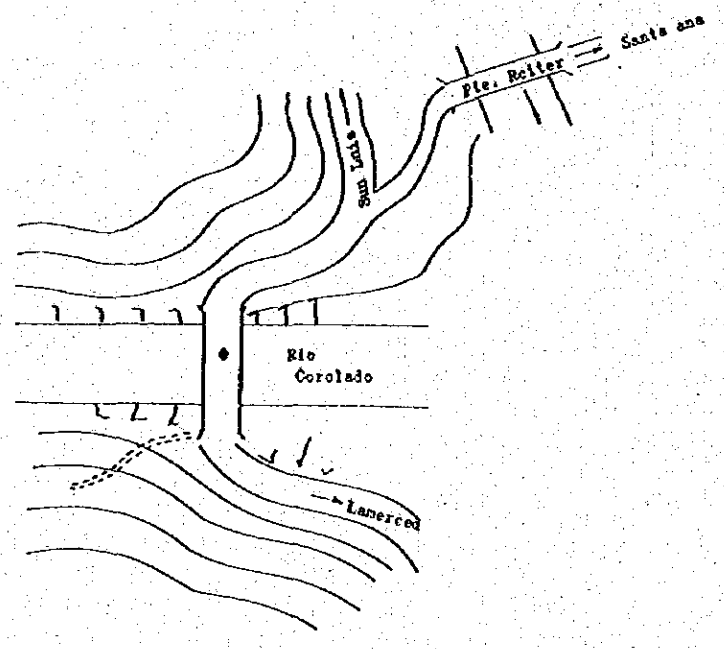
Photograph

Fig. 5 ILLUSTRATION OF STATION

Location of station Pte.Corolado Elevation H = 689.11 m

Junin-Tarma-La Merced

Illustration



Photograph

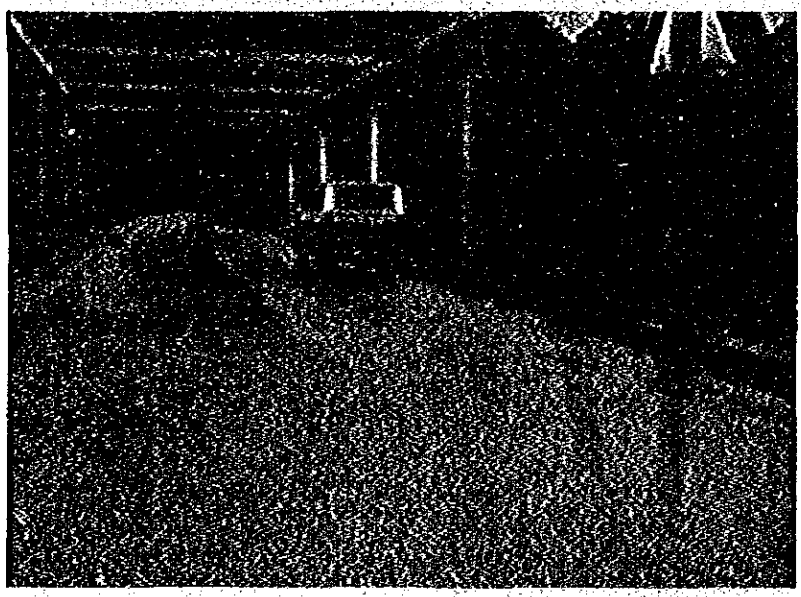
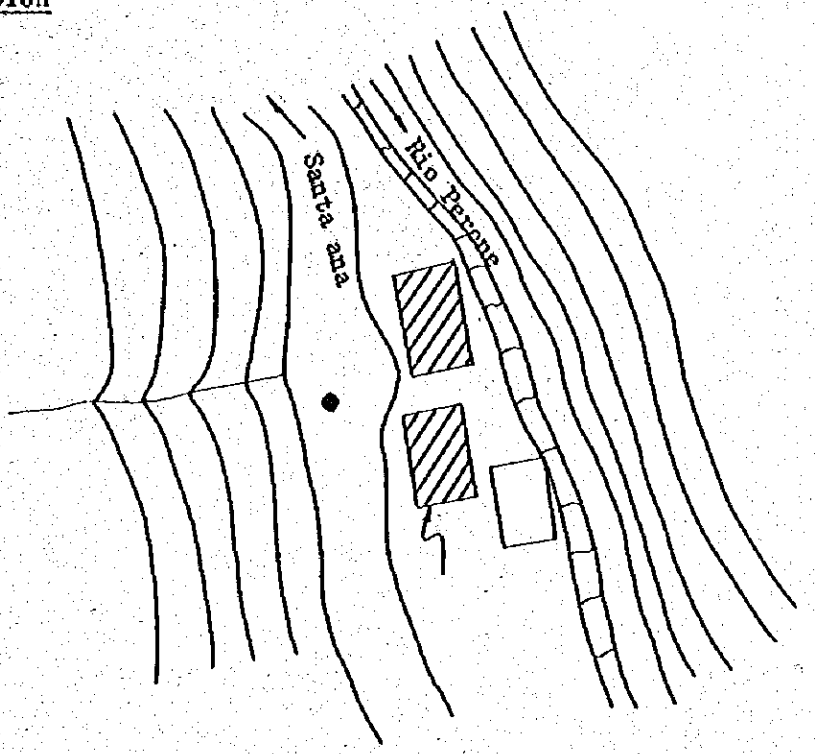


Fig. 6 ILLUSTRATION OF STATION

Location of station BOCA TIGRE Elevation H = 582.40 m

Junin-Tarma-Boca Tigre

Illustration



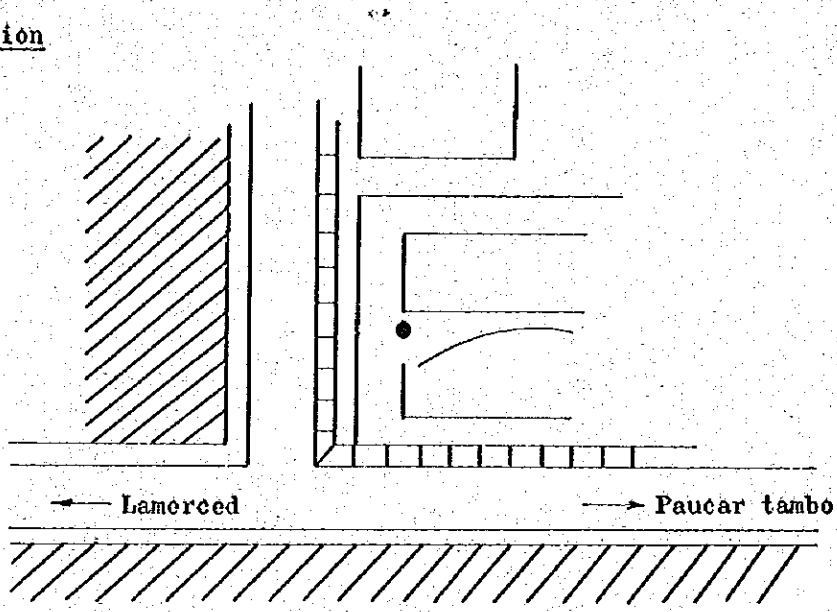
Photograph

Fig. 7 ILLUSTRATION OF STATION

Location of station San Luis Elevation H = 725.40 m

Junin-Tarma-San Luis

Illustration



Photograph

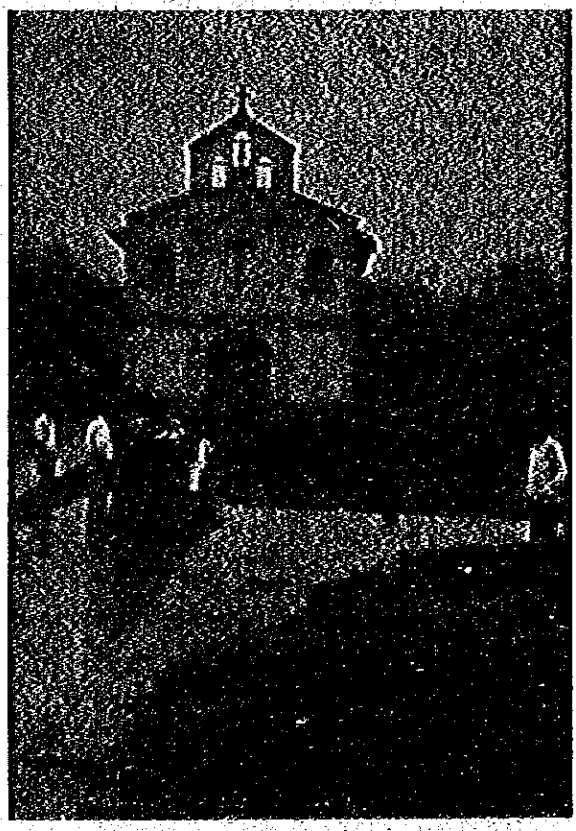


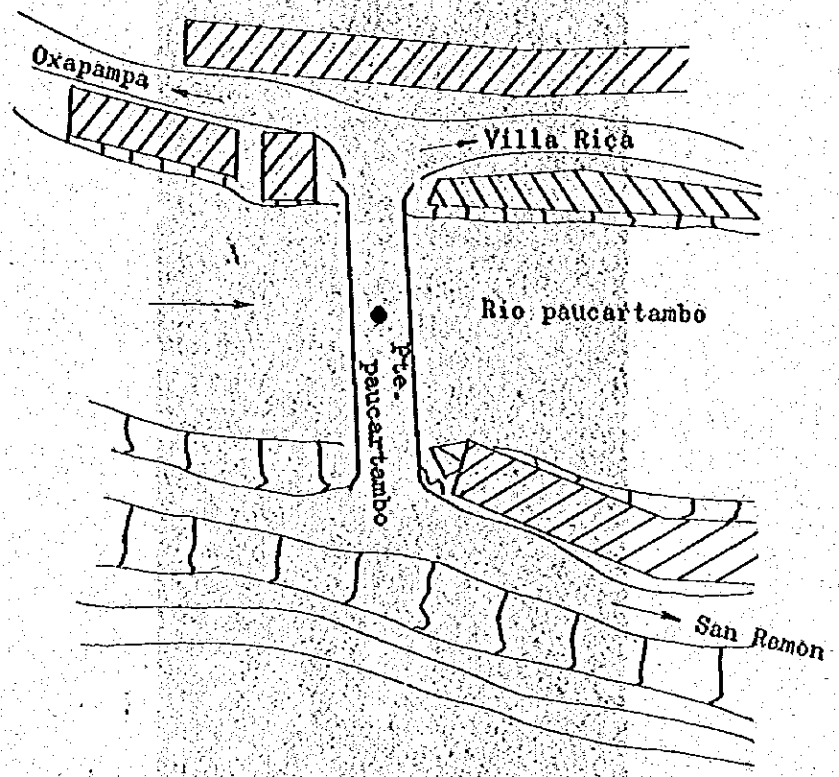
Fig. 8

ILLUSTRATION OF STATION

Location of station Paucartambó Elevation H = 785.88 m

Pasco-Serro de Pasco-Paucartambo

Illustration



Photograph

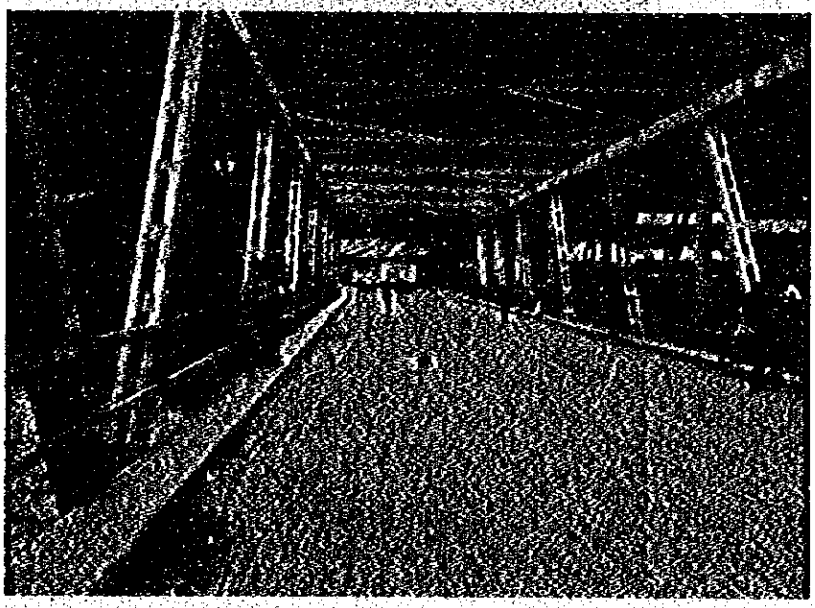


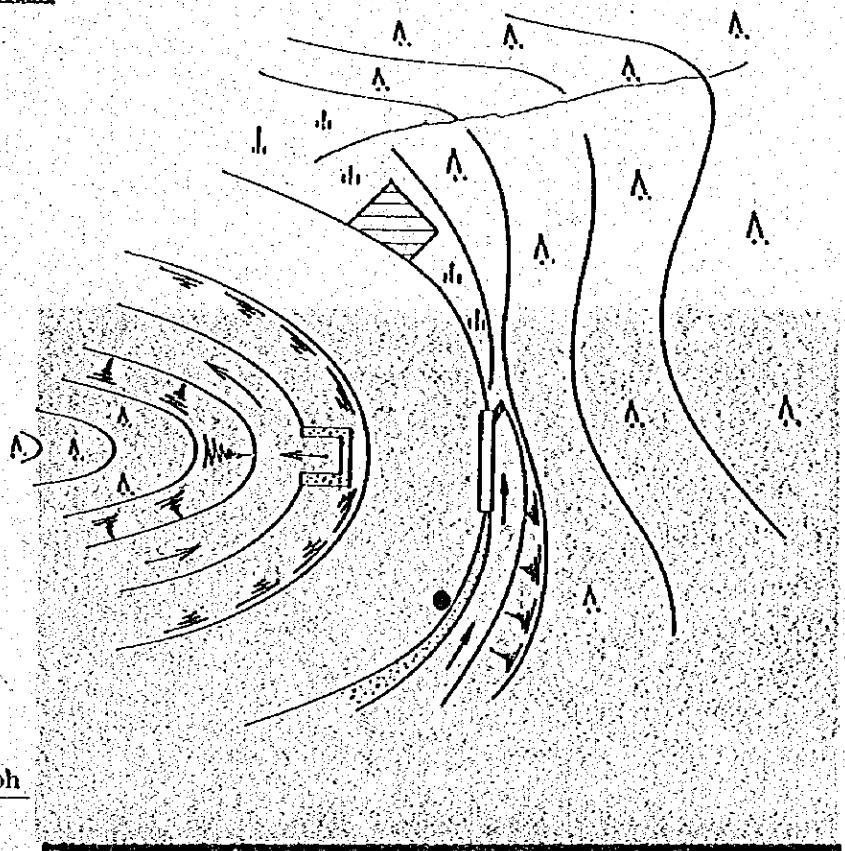
Fig. 9

ILLUSTRATION OF STATION

Location of station Paucartambo(B-2) Elevation H = 789.79 m

Pasco-Oxapampa-Paucartambo

Illustration



Photograph

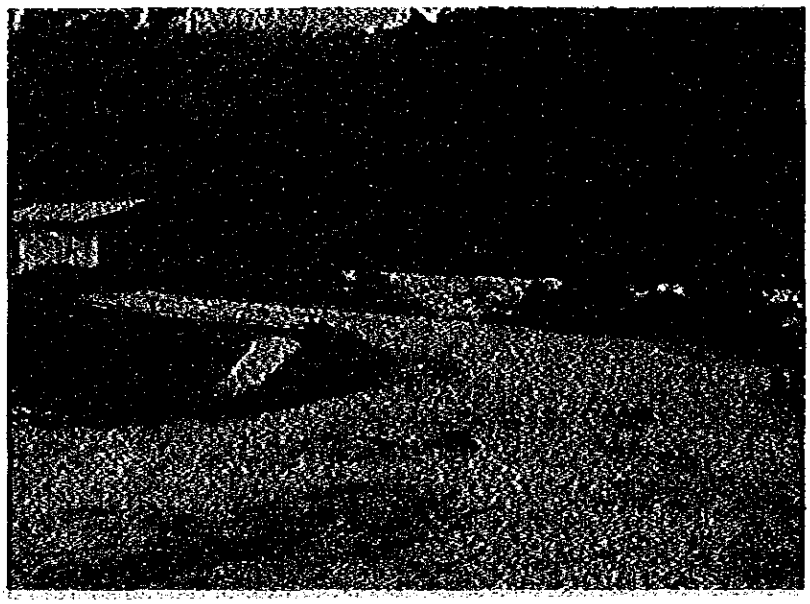
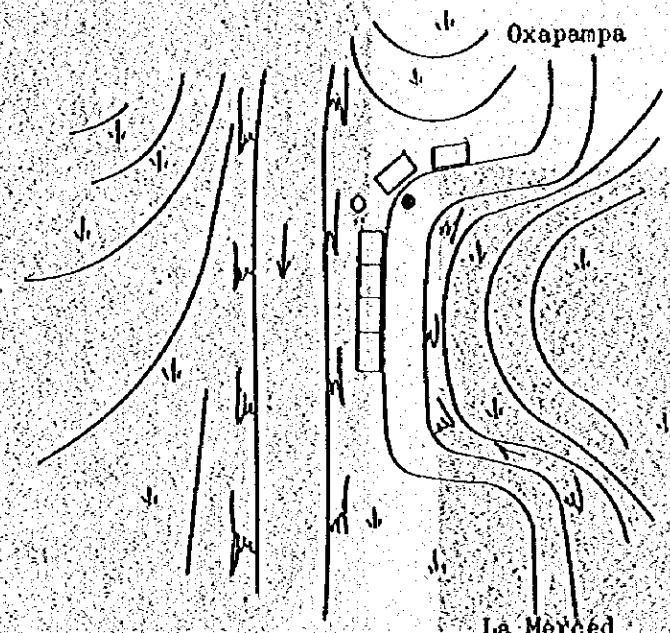


Fig. 10 ILLUSTRATION OF STATION

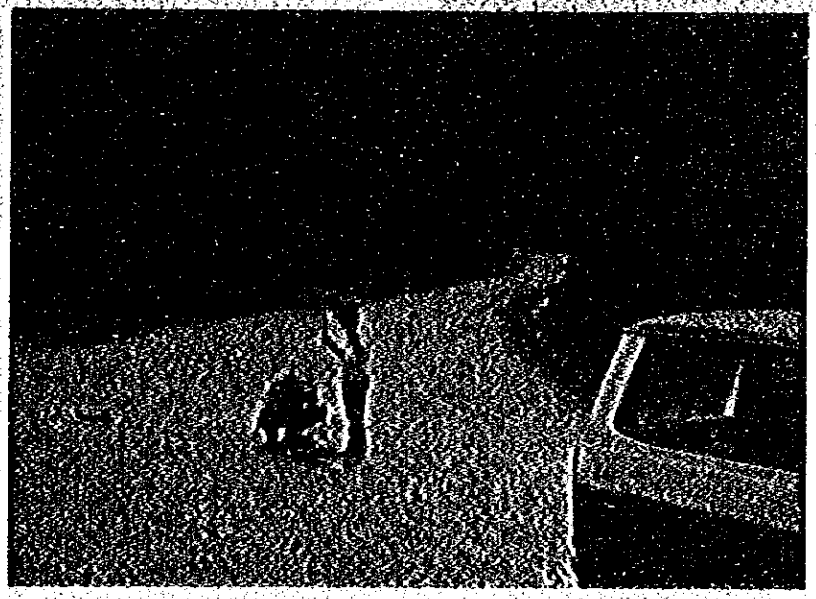
Location of station Churumazu(A-6) Elevation H = 907.48 m

Pasco-Oxapampa-Churumazu

Illustration



Photograph



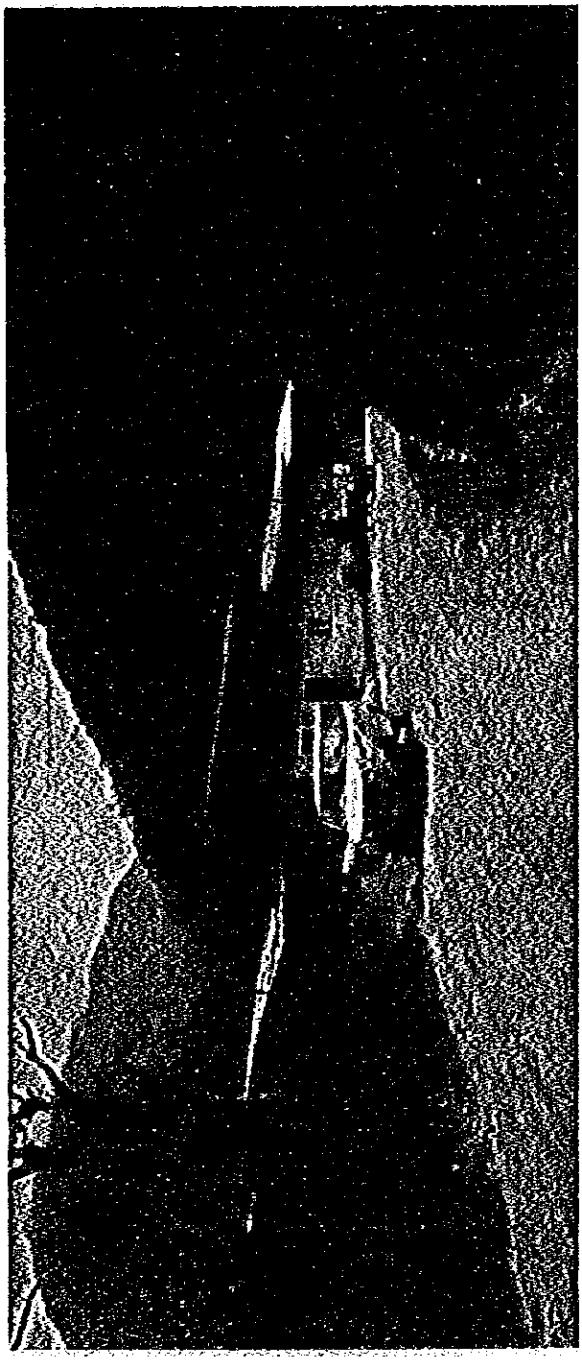
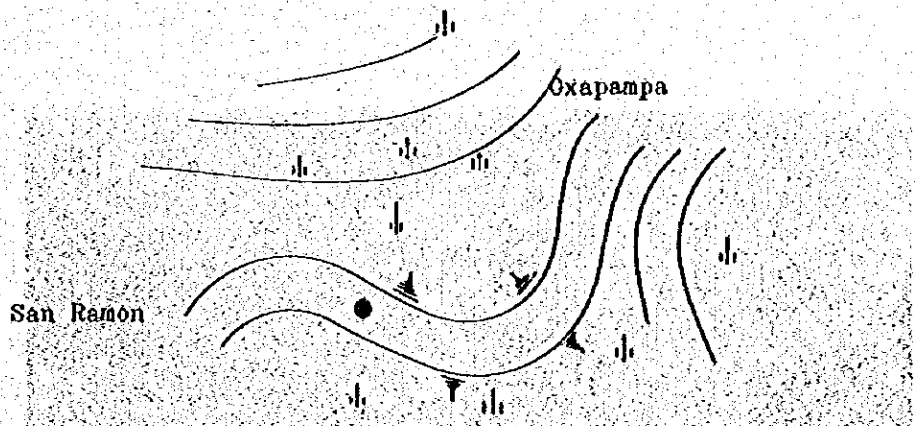


Fig. 11 ILLUSTRATION OF STATION

Location of station Mesapata Elevation H = 1135.60 m

Pasco-Oxapampa-Mesapata

Illustration



Photograph

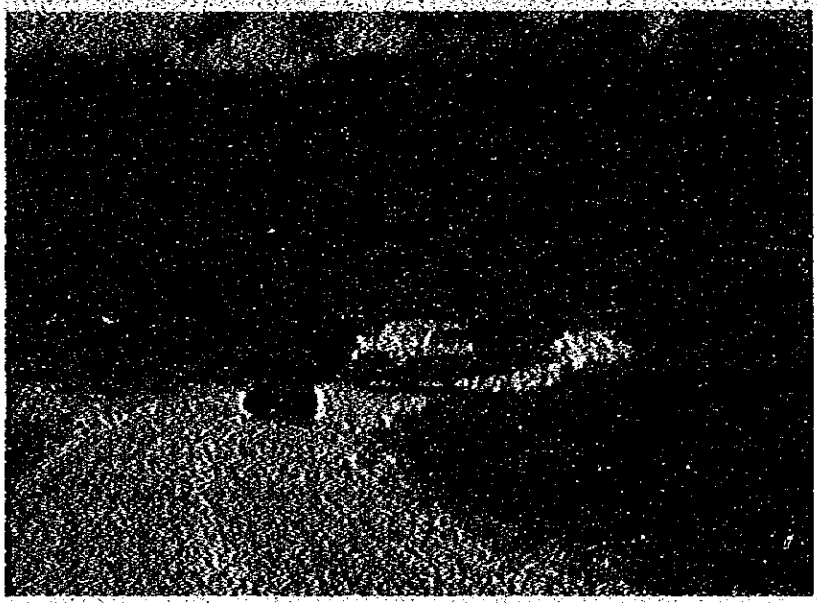


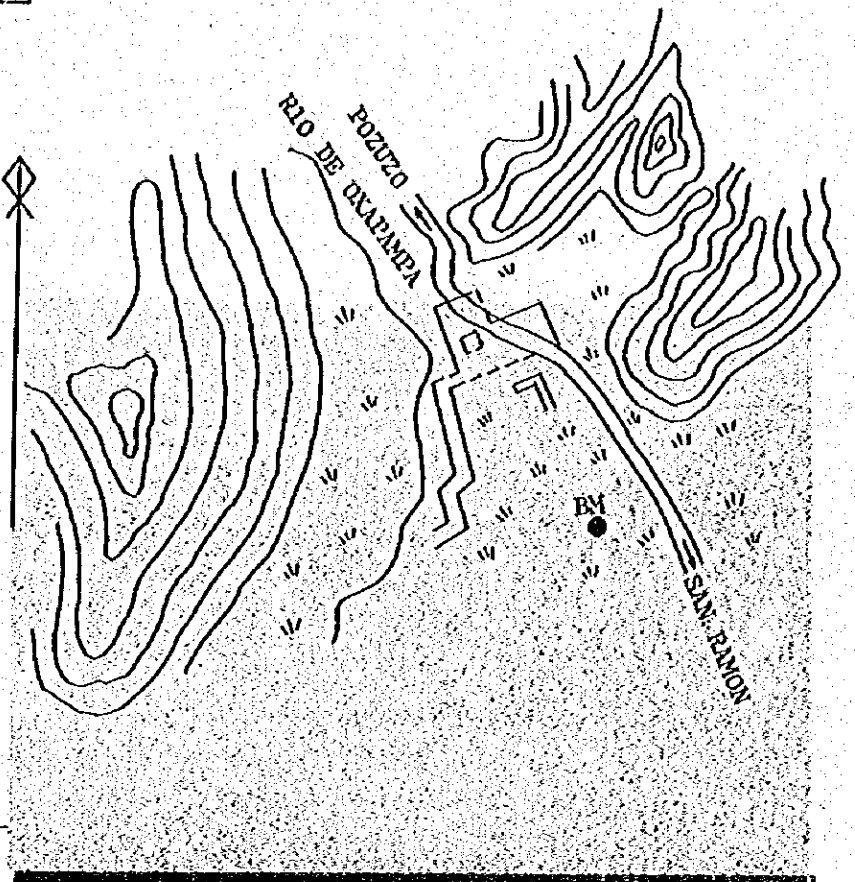
Fig. 12A

ILLUSTRATION OF STATION

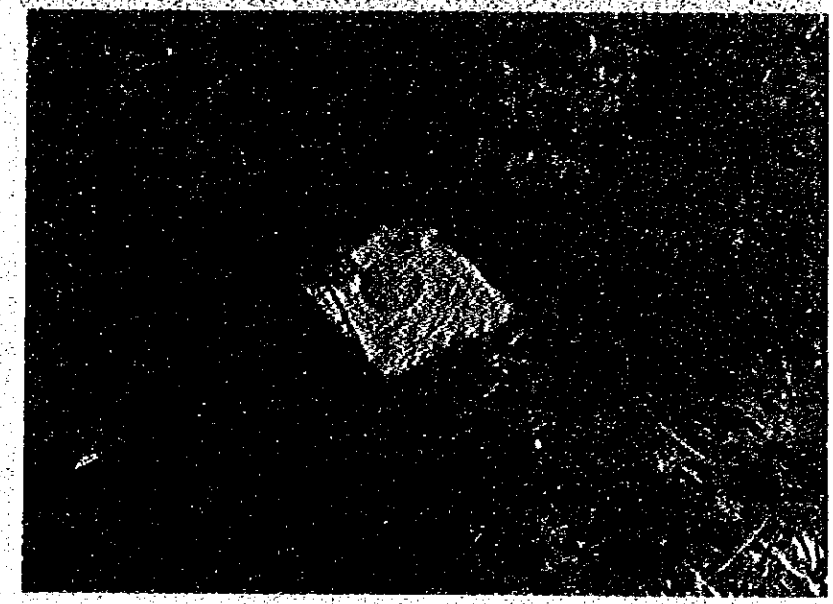
Location of station Oxapampa Elevation H = 1814±5 m

Pasco-Oxapampa-Oxapampa

Illustration



Photograph



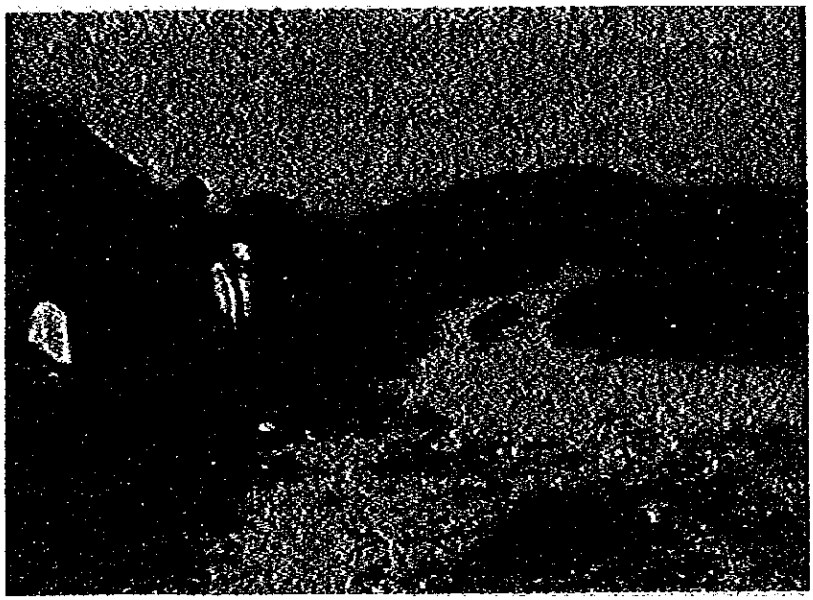


Fig. 12-B

GEODETIC SUMMARY

GEODETIC SATELLITE OBSERVATION STATION

LOCATION	EQUIPMENT	STATON NO.	OBSERVED BY (AGENCY)
Oxapampa, Peru	Geoceiver	30344	DMATC

TRACKING EQUIPMENT REFERENCE POINT	PERIOD OF OCCUPATION
Electrical Center of Antenna	21 July - 25 July 1974

TYPE OF STATION MARKER	AGENCY (CAST IN MARK)	STAMPING ON MARK
Bronze Disk	GEODESICO INTER-AMERICANO	GEOC EST 80844 OXAPAMPA 1974 IGM

GEODETIC COORDINATES (OF SATELLITE OBSN. STA.)		GRID COORDINATES (OF SATELLITE OBSN. STA.)			
LATITUDE ( ) '		NORTHING	EASTING	ZONE	GRID
S 10° 34' 53".719		8 830 242.8	456 481.0	18	UTM
LONGITUDE ( )		NORTHING (FT)	EASTING (FT)	ZONE	GRID
N 75° 23' 52".066					

DATUM	ELLIPSOID	TO OBTAIN GRID AZIMUTH, ADD TO THE GEODETIC AZIMUTH
South American Datum	International	
SURVEYED BY (AGENCY)		TO OBTAIN GRID AZ. (ADD) (SUB.) TO THE GEODETIC AZIMUTH
LOCATION OF SURVEY DATA		ELEVATION ESTABLISHED BY (AGENCY) / DATE / ORDER

ELEVATION OF MARK ABOVE MSL (GEOID)	HEIGHT OF GEOID ABOVE ELLIPSOID	HEIGHT OF TRACKING EQUIPMENT REF. PT.
1814. meters ± 5	-115. meters ± 5	ABOVE STATION MARKER 1.698 METERS
HEIGHT OF REFERENCE POINT ABOVE ELLIPSOID	DATUM USED FOR GEOID HEIGHTS	PHOTOIDENTIFICATION BY AGENCY; WHERE FILED:
1701. METERS	PSAD 1956	

GEODETIC AZIMUTH
ASTRONOMIC (FROM SOUTH)

FROM	TO	AZIMUTH	DISTANCE

*Derived from Doppler satellite position transform X = 281.885, Y= -106.277 and Z = 402.668 meters.

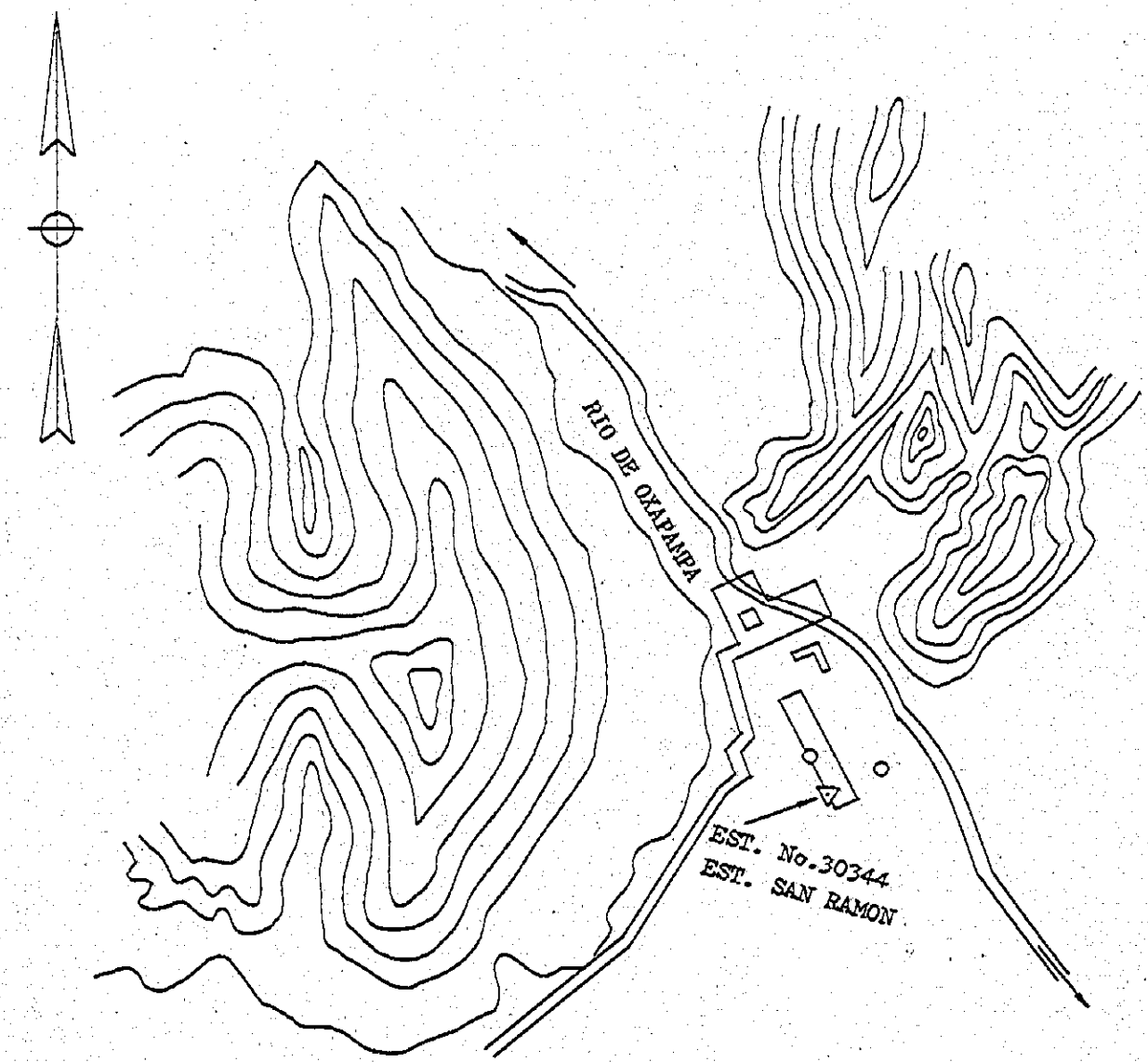
SKETCH OF STATION SITE AND VICINITY

SKETCH OF SURVEY (SHOW TIE TO LOCAL CONTROL)

The precision figures listed are for the geodetic coordinates refer to the datum as defined by established control in the area.

PREPARED BY (AGENCY)	DATE	REVISED BY (AGENCY)	DATE	REVISED BY (AGENCY)	DATE
DMATC	Feb 75				

Fig. 12-C



△ DOPPLER STATION
△ SURVEY MARK
○ REFRENCE MARK
□ BENCH MARK
⊙ VERTICAL PP
⊡ HORIZONTAL PP
⊡ HVPP
OBSERVED ANGLE
COMPUTED ANGLE
MEASURED DISTANC

VICINITY SKETCH

30344

Station number

Fig. 12-D

COUNTRY	TYPE OF MARK	STATION	
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (FT) (M)
LATITUDE	LONGITUDE	DATUM	DATUM
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE / ORDER

TO OBTAIN	AZIMUTH OR DIRECTION	TO THE GEODETIC AZIMUTH
TO OBTAIN	GRID AZ. (ADD)(SUB.)	TO THE GEODETIC AZIMUTH

OBJECT	Azimuth or direction (GEODETIC)(GRID) (MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)

The station is located 120 Km North of the town of San Ramon, Peru.

Station marker is a b IAGS type disk embedded in A .30 x 30 m and 1,00 meter deep concrete block approximately 8.0 c m. DY from the left south corater of the oxapamda airstrip, and 35 m above the ground. An underledund marker uas stablished.

The IAGS station marker is stamded gedc. est. 30344. oxapampa - 194 - IGM.

RM 1 is a IAGS bronce type disk EM bedded in a .30 x 30 m and 3 D.m. concrete block above the grannd and is located 14.00 m on a magnetic azimuth of 3.33° from the station.

RM 2 same as addve except for a distance of 23.80 m on a magnetic azimuth of 70° from the station.

The azimuth marker is located 1.5 Km on top of a rider on a maranetic azimuth of 140° from the station

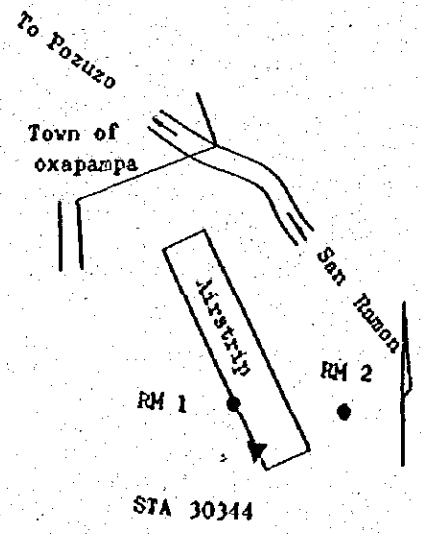


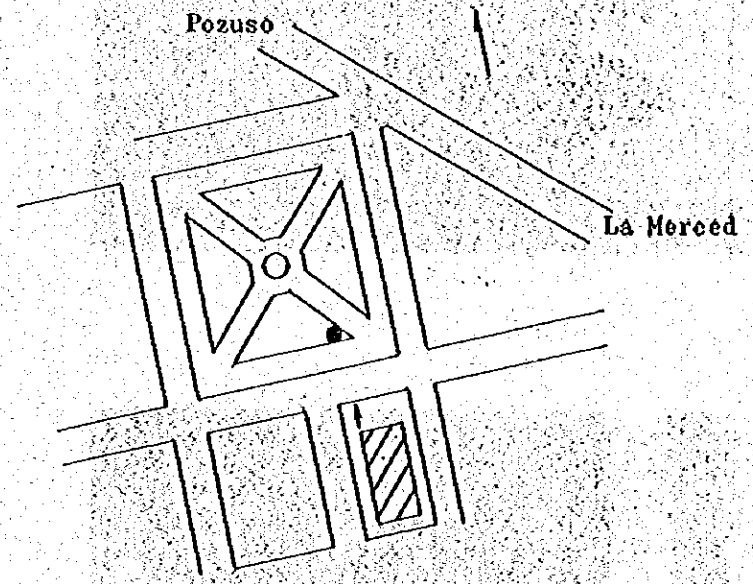
Fig. 13-A

ILLUSTRATION OF STATION

Location of station Oxapampa Elevation H = 1813.54 m

Pasco-Oxapampa-Oxapampa

Illustration



Photograph

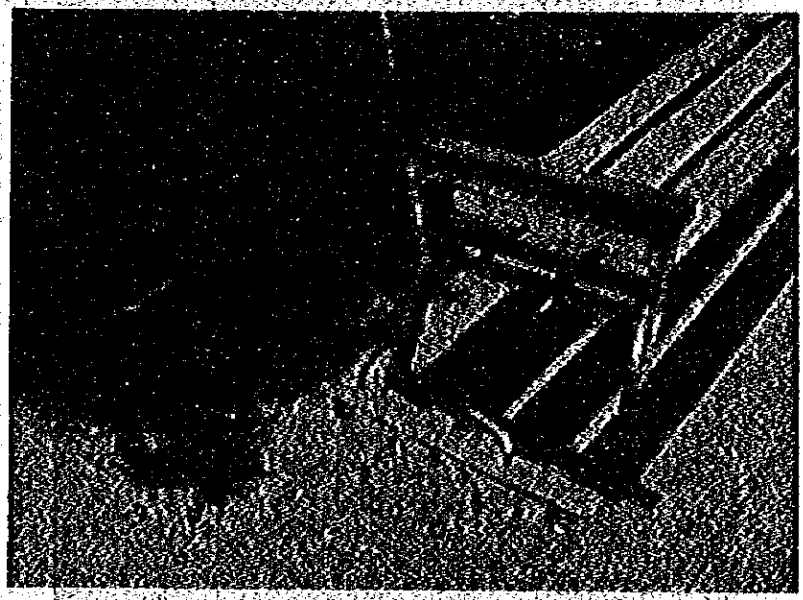
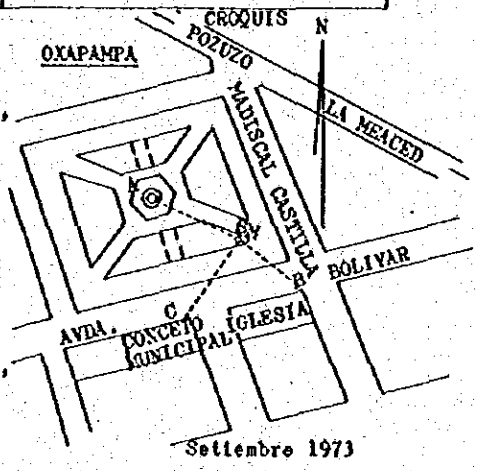


Fig. 13-B

PAIS: PERU	Característica de la marca: DISCO DE BRONCE 9 CM. DIAMETRO	DESIGNACION: P-360
DEPARTAMENTO: PASCO	Establecida por (Organización)	ELEVACION: 1813, 5409 (M)
PROVINCIA: OXAPAMPA	Organización (Fundida en la marca): OIA	ORDEN: PRIMER (FINAL) (PRELIMINAR)
LINEA: OXAPAMPA - POZUZO	Estampada: P-360-IGM-1959	DATUM
TRAMO		

DESCRIPCION DETALLADA DEL PUNTO

A lo largo de la carretera afirmada entre los pueblos de Oxapampa y San Ramón, partiendo de la Plaza de Armas de Oxapampa, el monumento está al SE. a 0.0 millas situado en la Plaza de Armas de Oxapampa, está al costado NW de la calle Bolivar, y al mismo nivel con respecto a la misma.



REFERENCIAS:

a.- Desde el centro del Ovelisco al centro de la Plaza de Armas, con azimut magnetico 117° está a 49.00 mts.

b.- Desde la esquina NW. de la Iglesia Principal, con azimut magnetico 310° está a 27.10 mts.

c.- Desde la esquina NW. de la Municipalidad, con azimut magnetico 33° está a 49.80 mts.

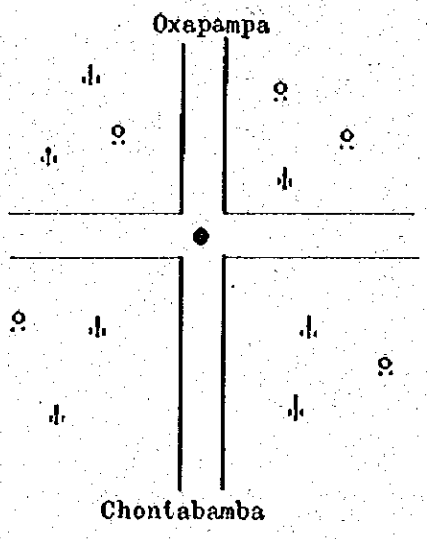
El terreno alrededor es plano y edificado.

Fig. 14 ILLUSTRATION OF STATION

Location of station Chontabamba Elevation H = 1823.67 m

Pasco-Oxapampa-Chontabamba

Illustration



Photograph

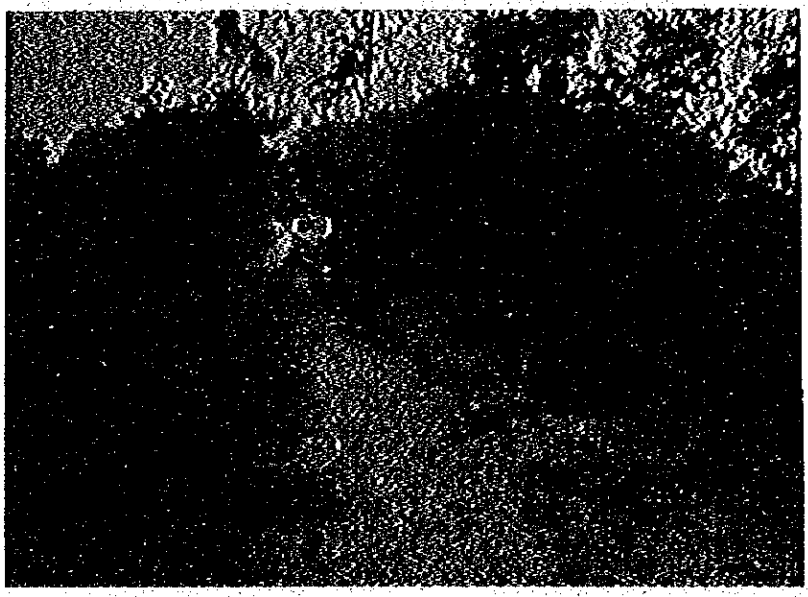
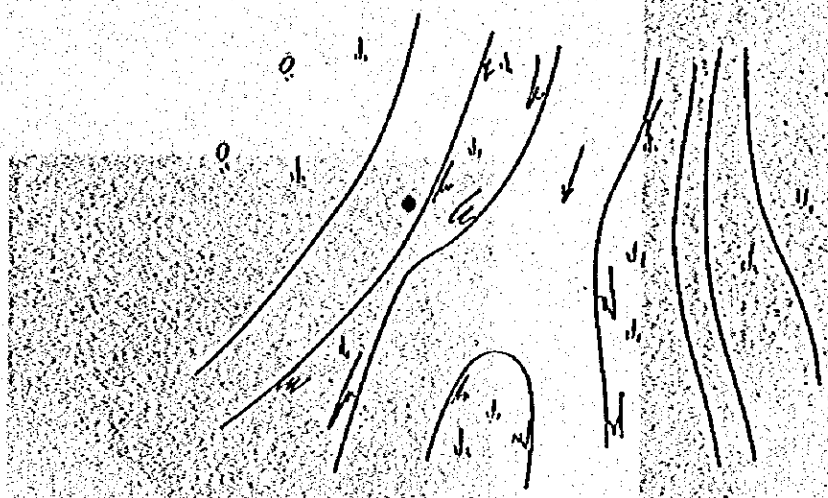


Fig. 15 ILLUSTRATION OF STATION

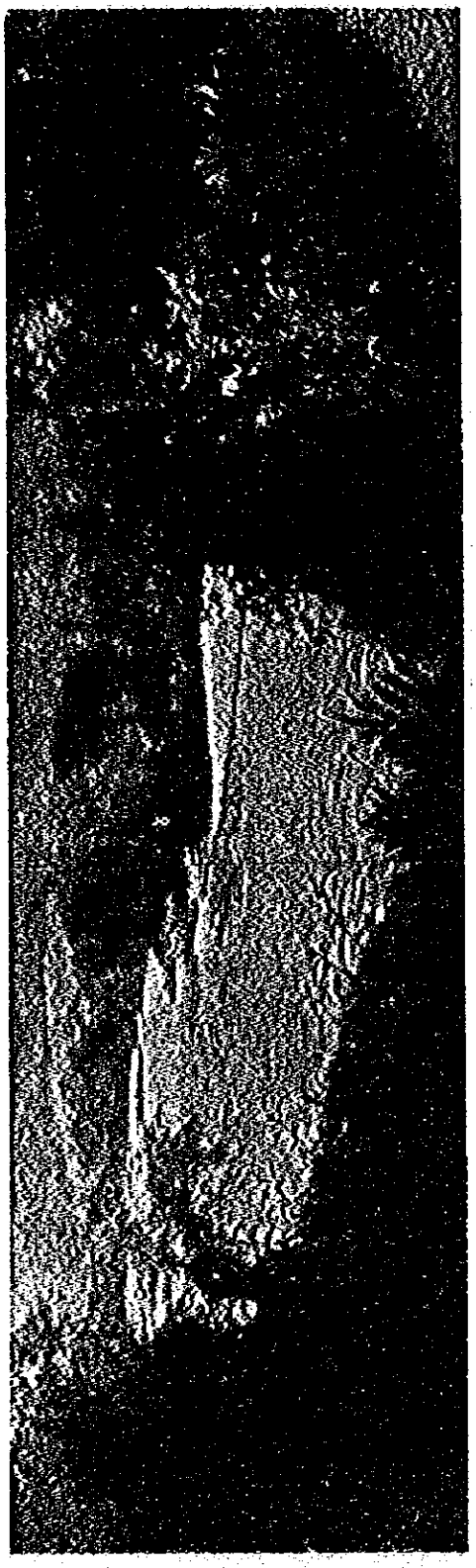
Location of station Chontabamba(A-3) Elevation H = 1832.08 m

Pasco-Oxapampa-Chontabamba

Illustration



Photograph



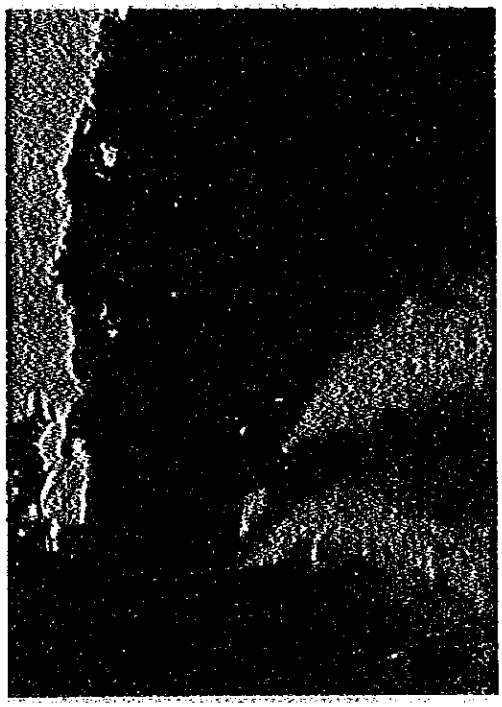
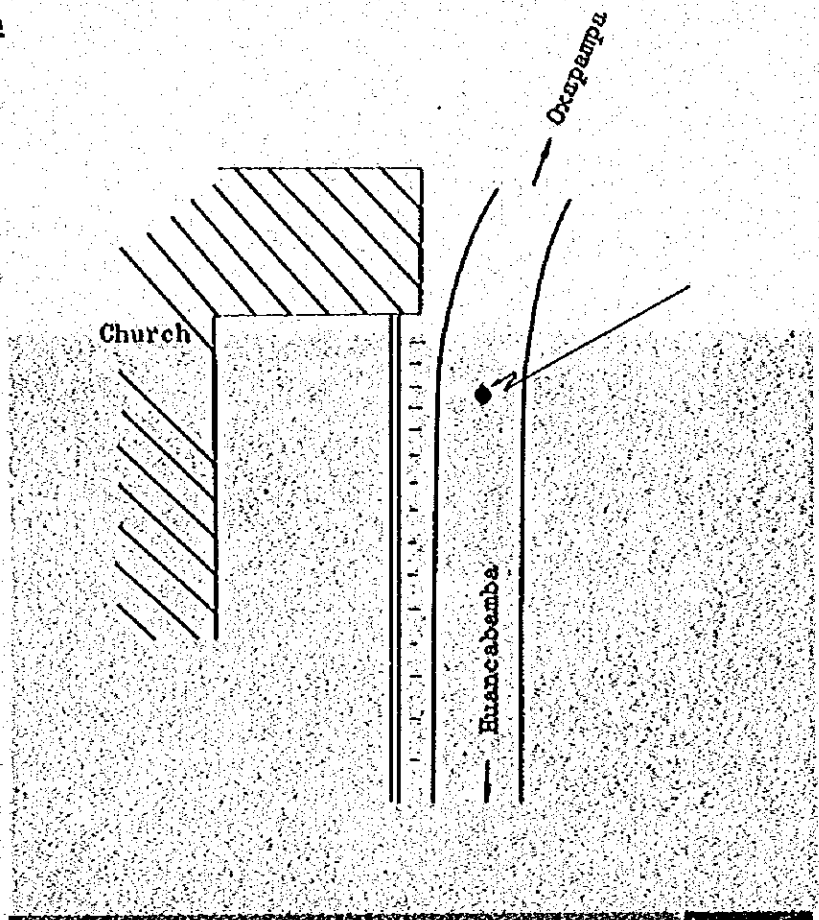


Fig. 16 ILLUSTRATION OF STATION

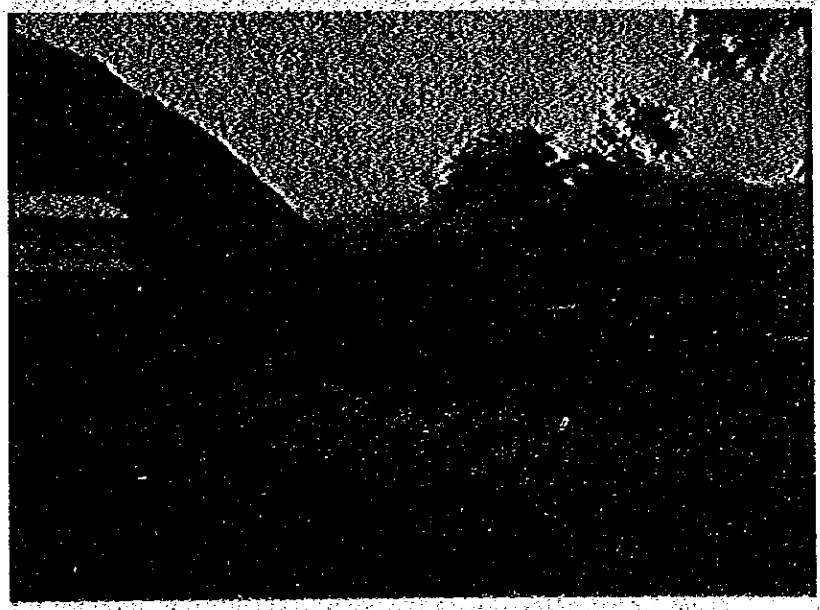
Location of station Quillazū Elevation H = 1808.49 m

Pasco-Oxapampa-Quillazū

Illustration



Photograph



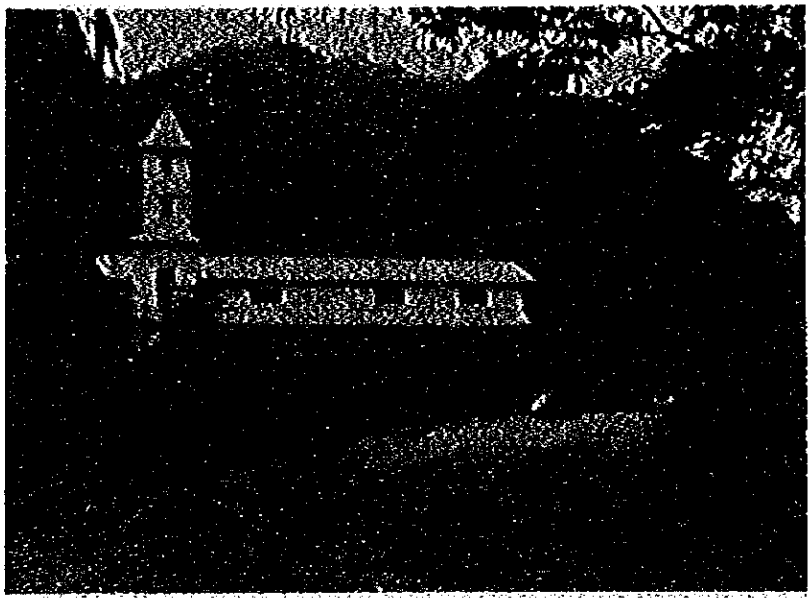
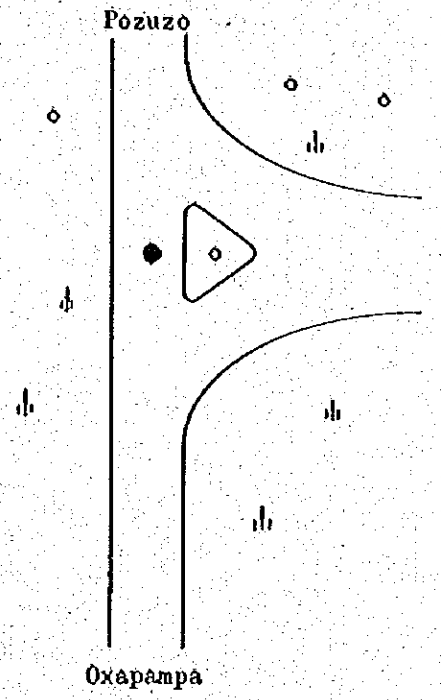


Fig. 17 ILLUSTRATION OF STATION

Location of station Pallamazu(B-1) Elevation H = 1766.26 m

Pasco-Oxapampa-Pallamazu

Illustration



Photograph

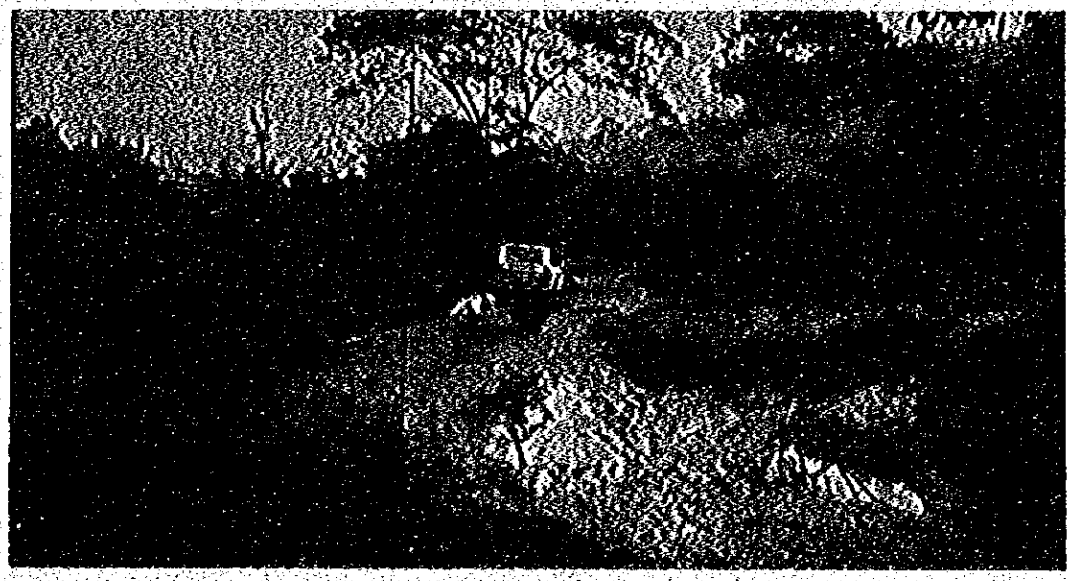


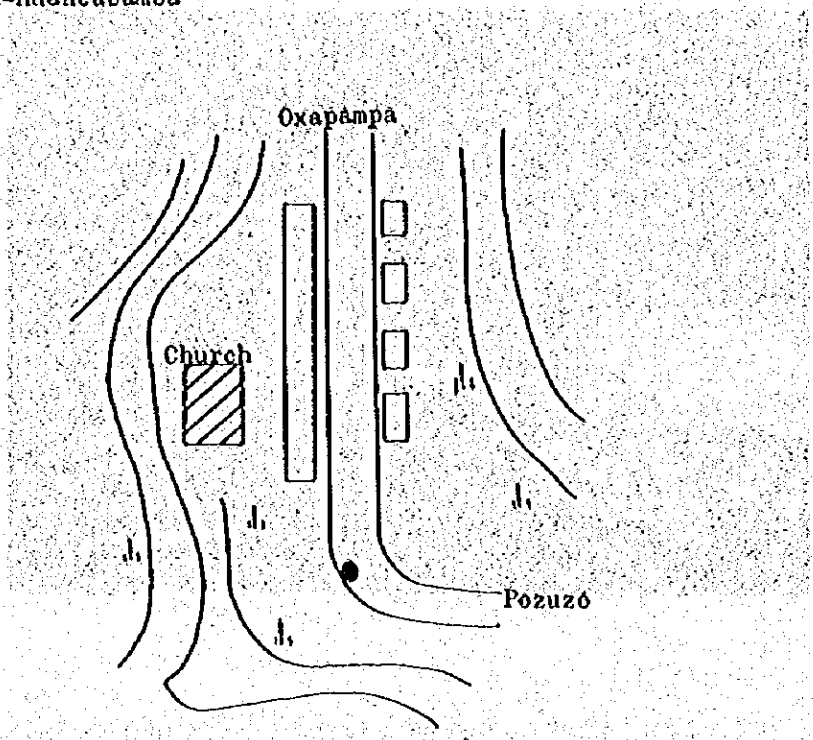
ILLUSTRATION OF STATION

Fig. 18

Location of station Huancabanba Elevation H = 1747.16 m

Pasco-Oxapampa-Huancabamba

Illustration



Photograph

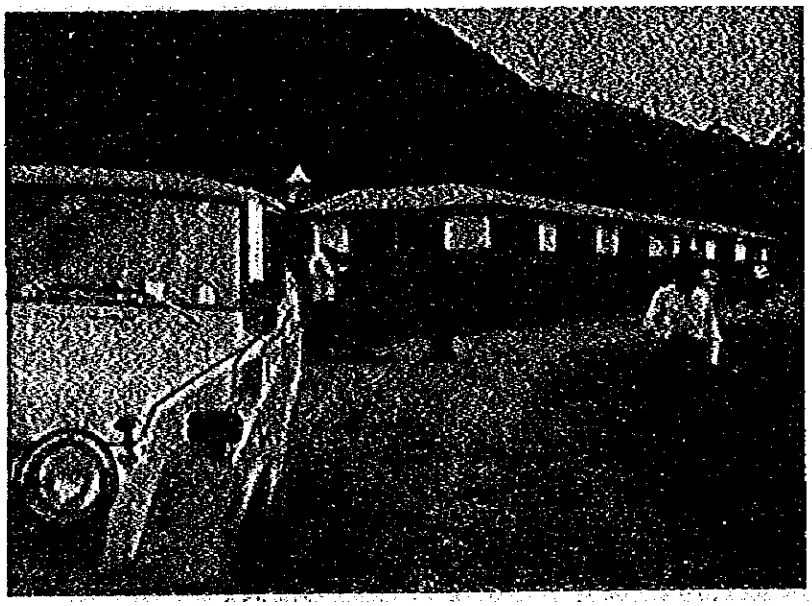
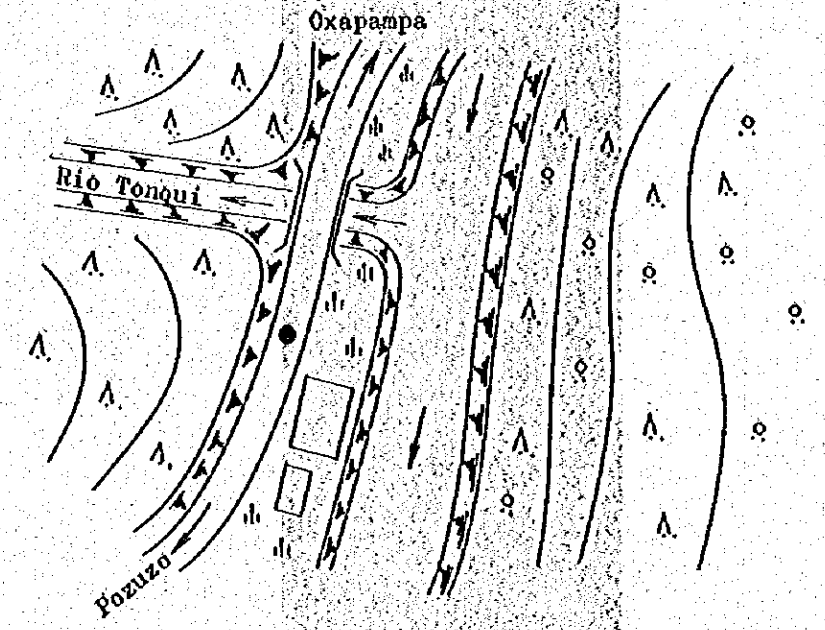


Fig. 19 ILLUSTRATION OF STATION

Location of station Rio Tonqui Elevation . H = 1420.40 m

Pasco - Oxapampa - Sunpedro

Illustration



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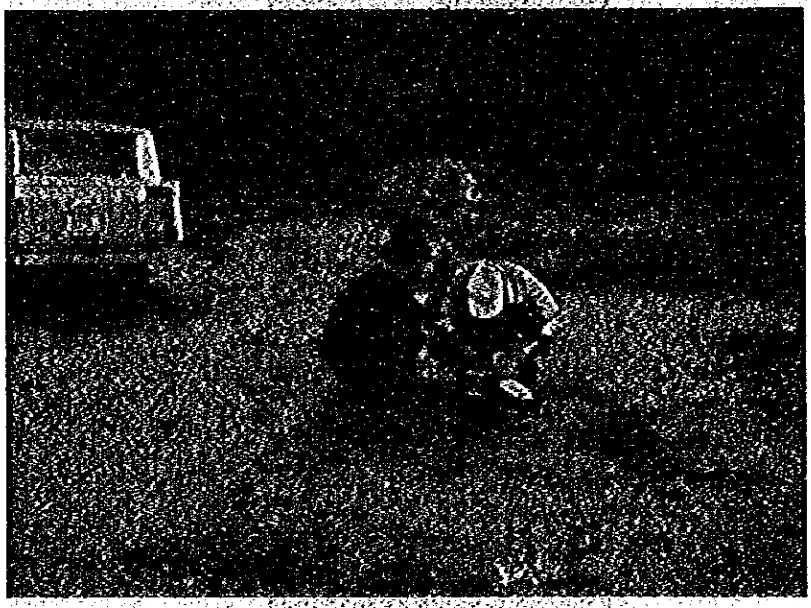


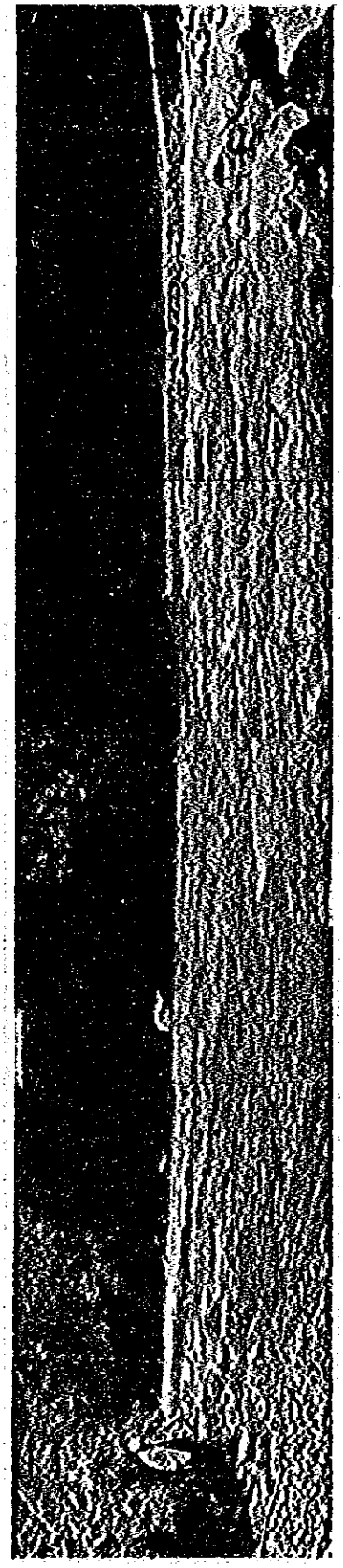
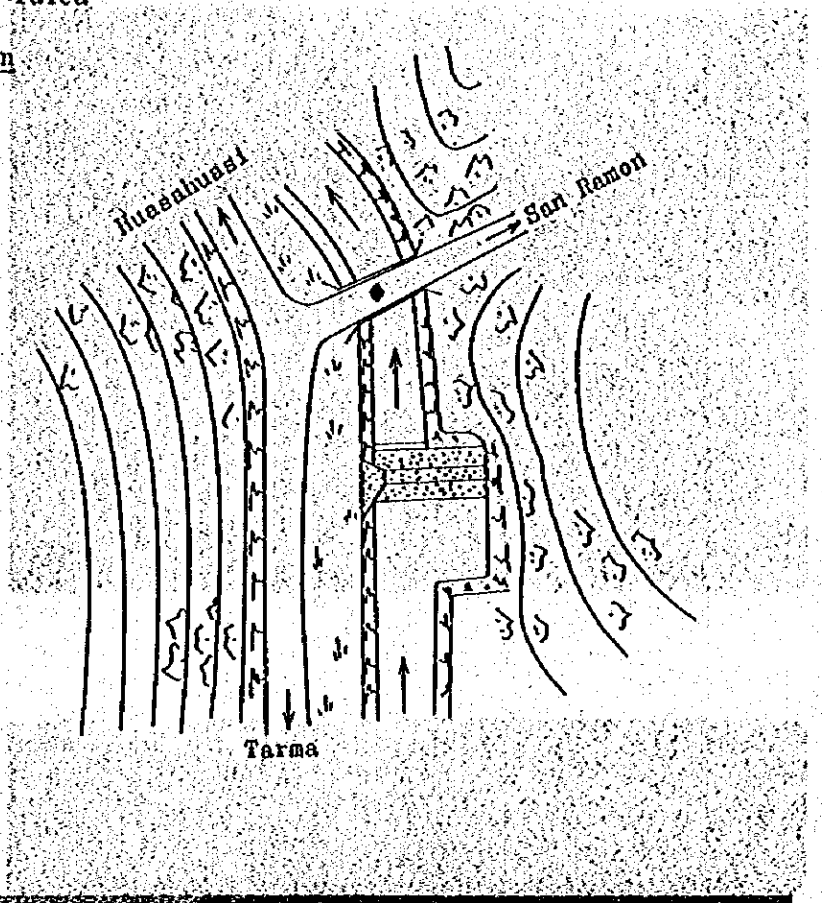


Fig. 20 ILLUSTRATION OF STATION

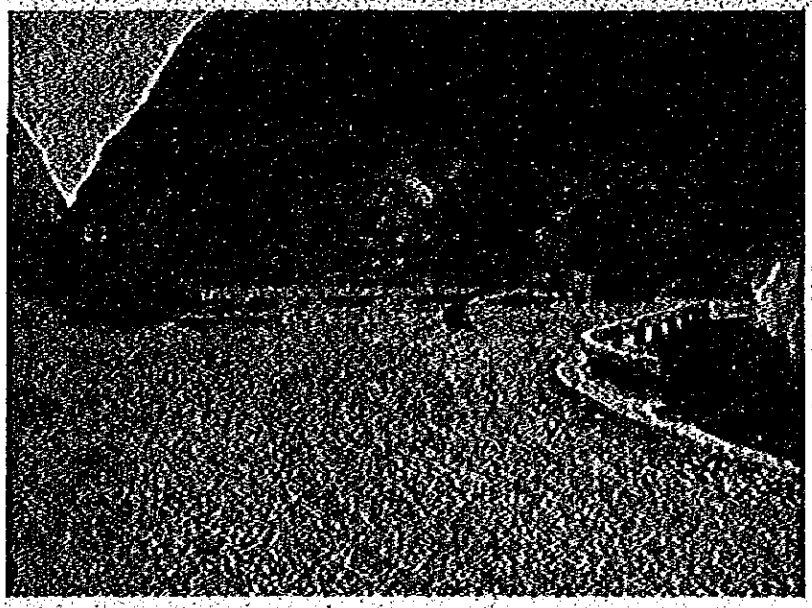
Location of station Huayagniu Elevation H = 2451.70 m

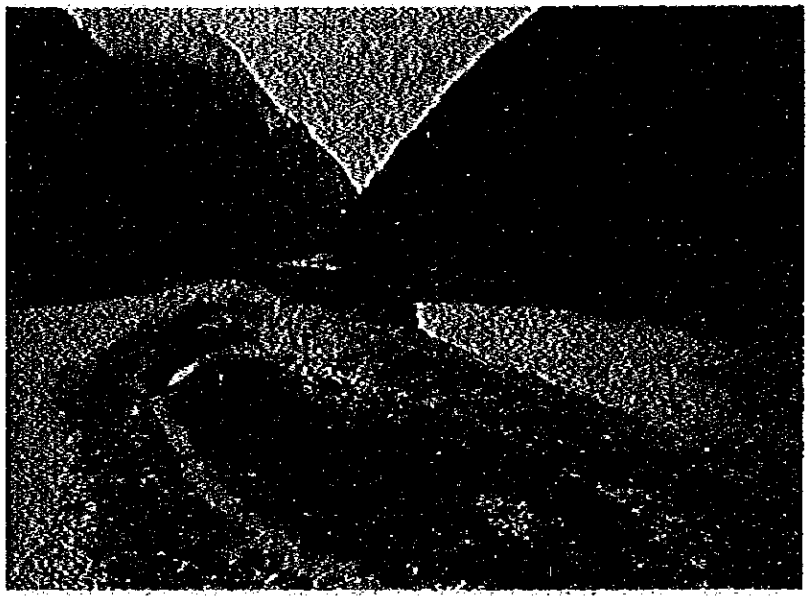
Junin-Tarma-Palca

Illustration



Photograph





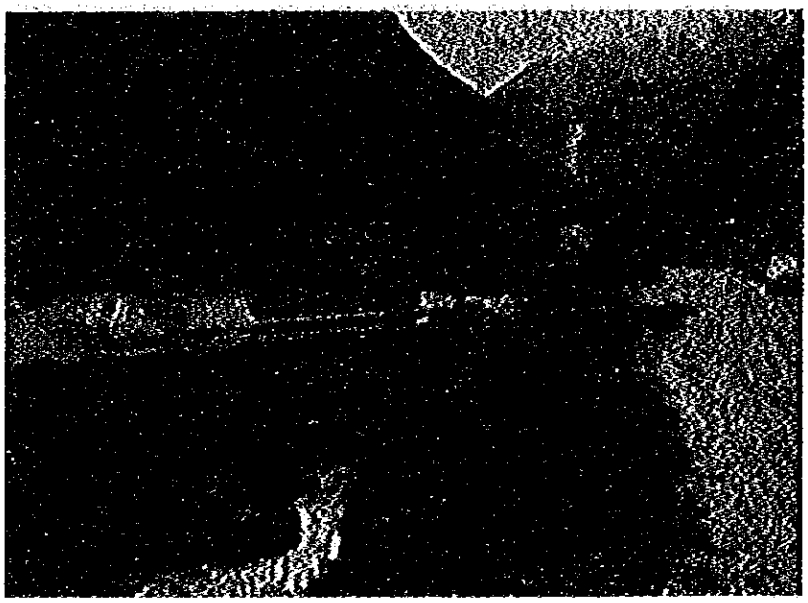
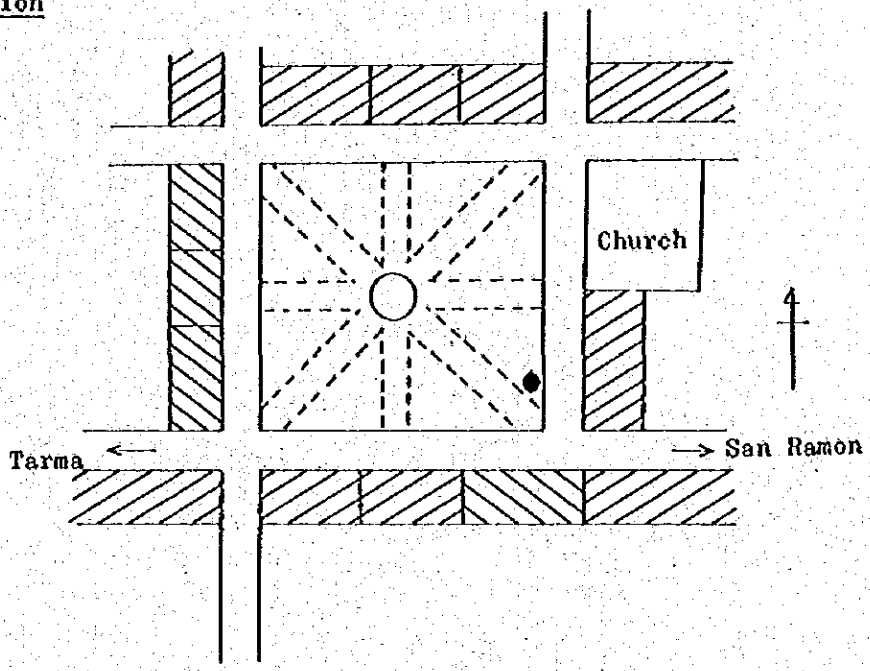


Fig. 21 ILLUSTRATION OF STATION

Location of station Palca Elevation H = 2728.59 m

Junin-Tarma-Palca

Illustration



Photograph

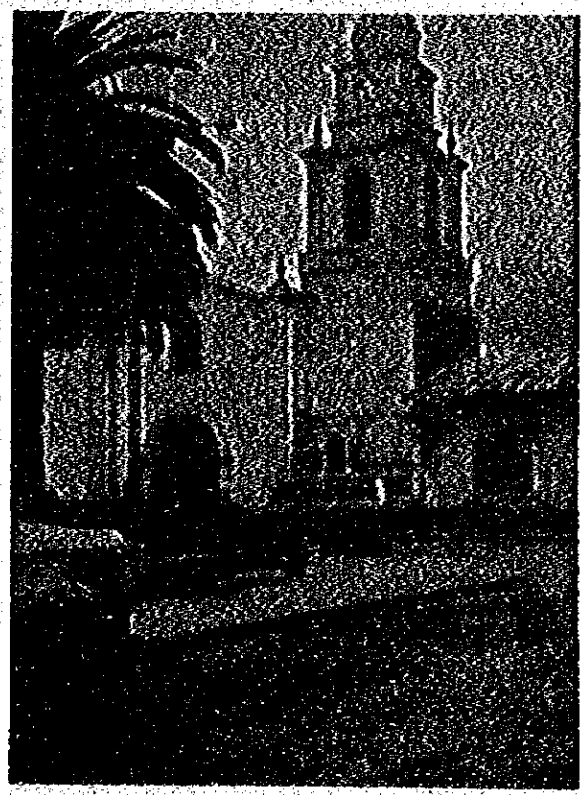


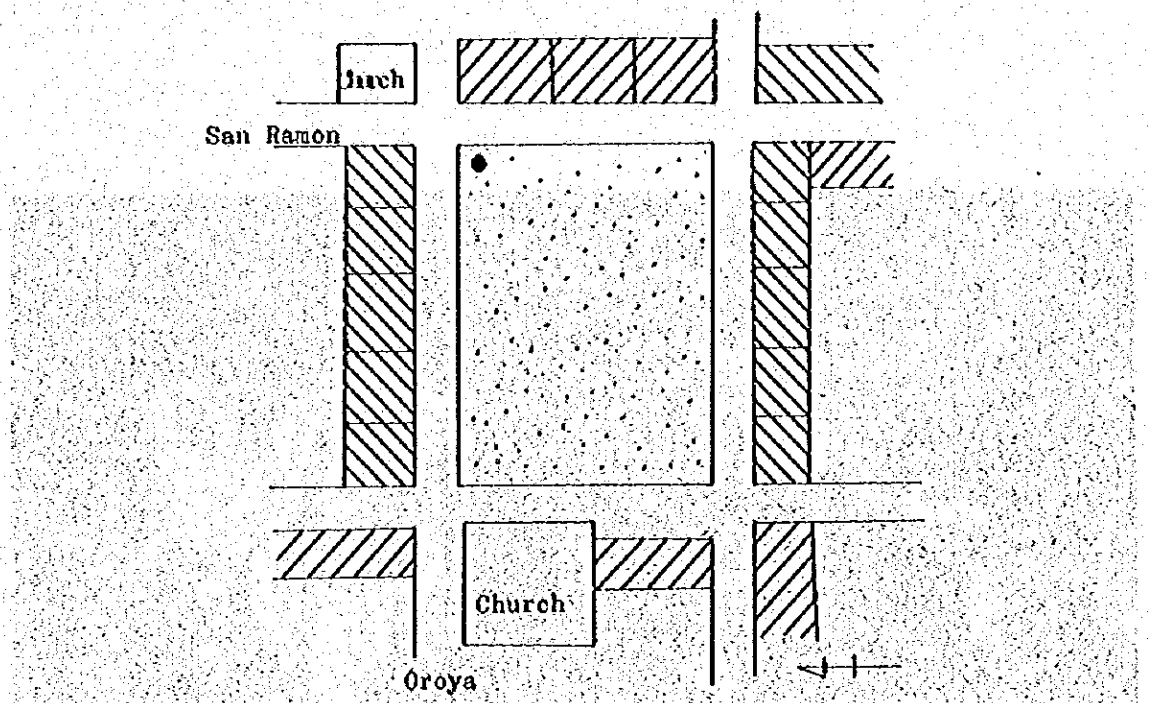
Fig. 22-A

ILLUSTRATION OF STATION

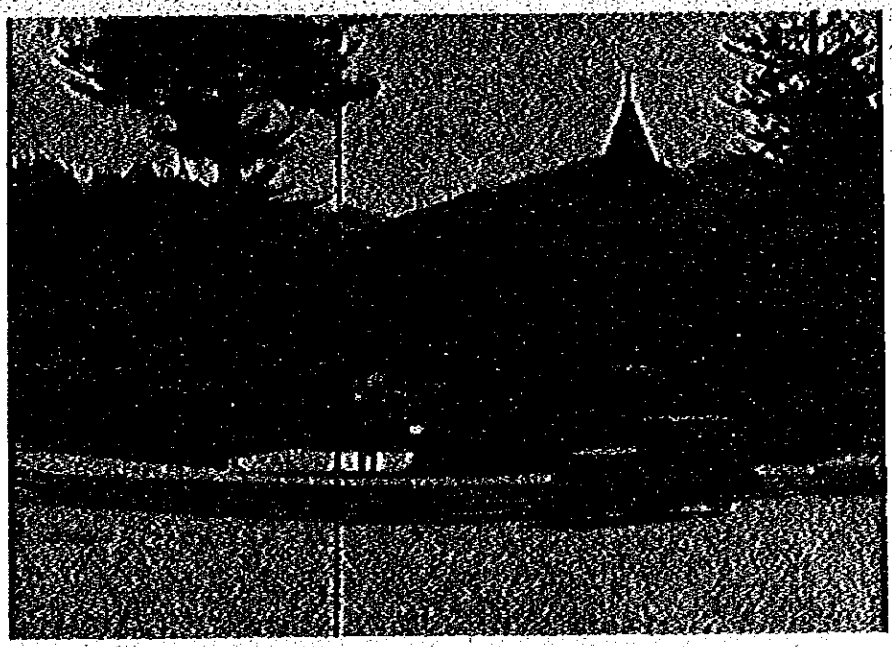
Location of station Tarma Elevation H = 3051.27 m

Junin-Tarma-Tarma

Illustration



Photograph



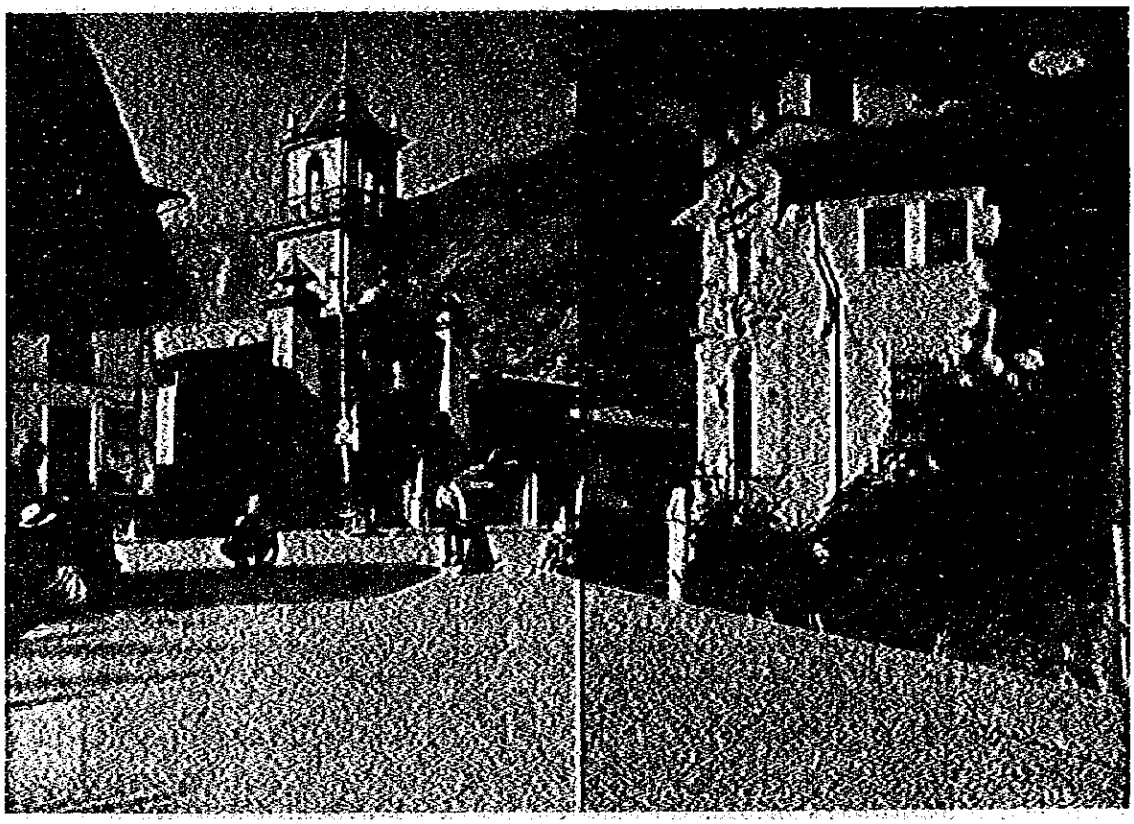


Fig. 22-B

PAIS: PERU	CARACTERISTICA DE LA MARCA: Disco de Bronce de 9 cms.	DESIGNACION: U 356
PROVINCIA, ESTADO, O DEPARTAMENTO: JUNIN	ESTABLECIDA POR (ORGANIZACION): IGM	ELEVACION: 3051,2724
MUNICIPIO, COMUNA, O CANTON	ORGANIZACION (FUNDIDA EN LA MARCA): SOIA	ORDEN
LINEA: LA OROYA - OXAPAMPA	ESTAMPADA: U 356 IGM 1959 PERU	DATUM

DESCRIPICION DETALLADA DEL PUNTO:

A lo largo de la carretera Oroya-Oxapampa, entre los pueblos de Oroya y Tarma partiendo de la Plaza de Armas de Tarma, el monumento está al E. a 0.0 Mi. situad situado en la Plaza de Armas de Tarma. Está al costado S. a 9.50 mts. del eje de la carretera y a 0.20 mts. mas alto del nivel del terreno que lo circun da.

Desde la esquina SO, de una Ilgesia con azimit magnéticó 225° está a 23.10 mts., desde la puerta principal del Concejo Provincial con azimit magnético 270° está a 21.0 mts. y desde la esquina NE de la Iglesia Matriz con azimit 65° está a 100.0 mts.

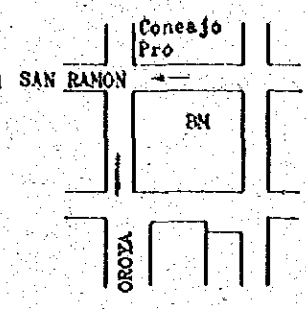
Desde la marca el eje de la carretera a 30 mts. al E. está 1.0 mts. mas bajo, a 30 al O. está 0.0 mts y frente a la marca 0.50 mts. mas bajo.

El terreno alrededor es irregular.

La fotoidentificación es practicable.

CROQUIS

Plana de Armas de Tarma



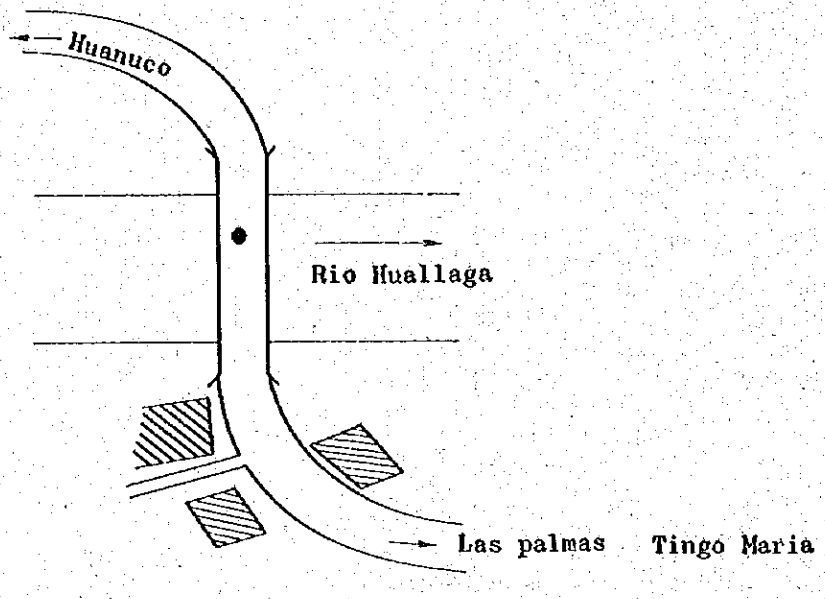
AGOSOTO 1959

Pig. 23 ILLUSTRATION OF STATION

Location of station Pet.Cayunba,G Elevation H = 779.45 m

Huanuco-Tingo Maria-Las Palmas

Illustration



Photograph

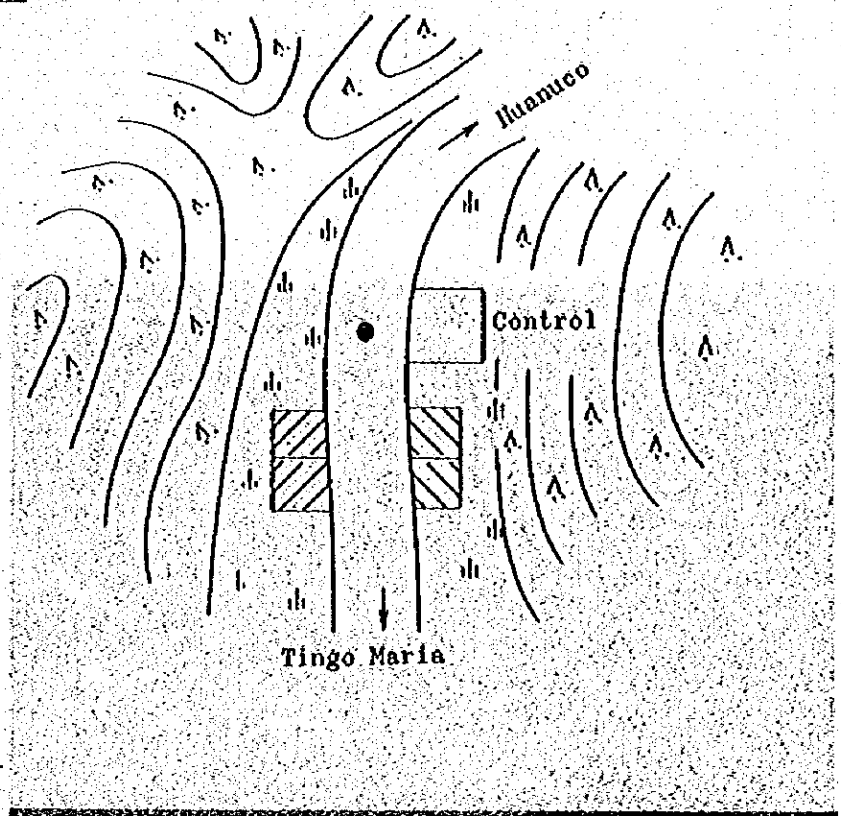
Fig. 24

ILLUSTRATION OF STATION

Location of station Las Palmas Elevation H = 722,46 m

Huanuco-Tingo Maria-Las Plamas

Illustration



Photograph

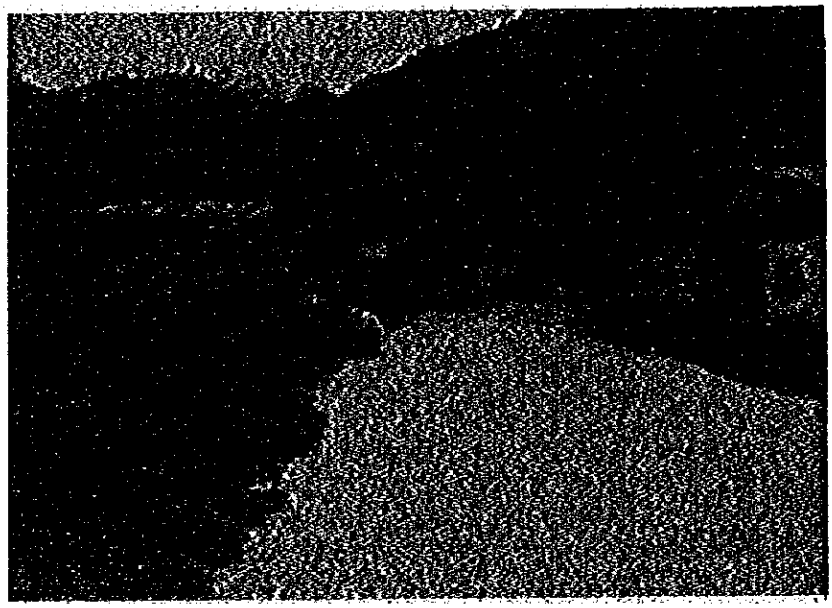


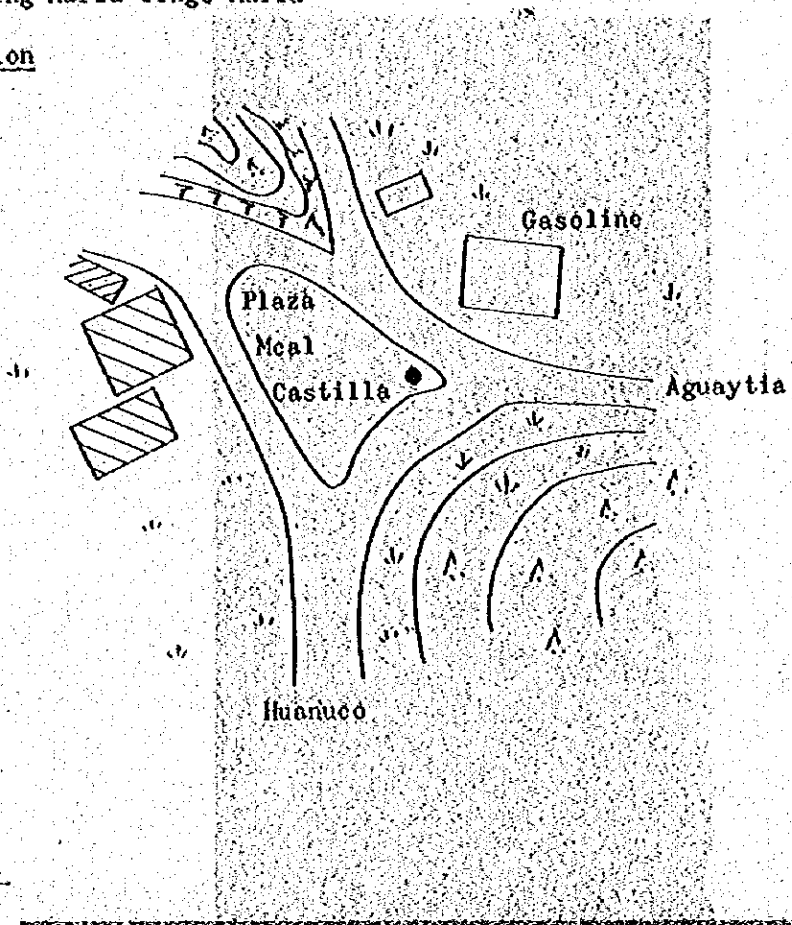
Fig. 25-A

ILLUSTRATION OF STATION

Location of station Tingo Maria Elevation H = 652.45 m

Huanuco-Ting Maria-Tingo Maria

Illustration



Photograph

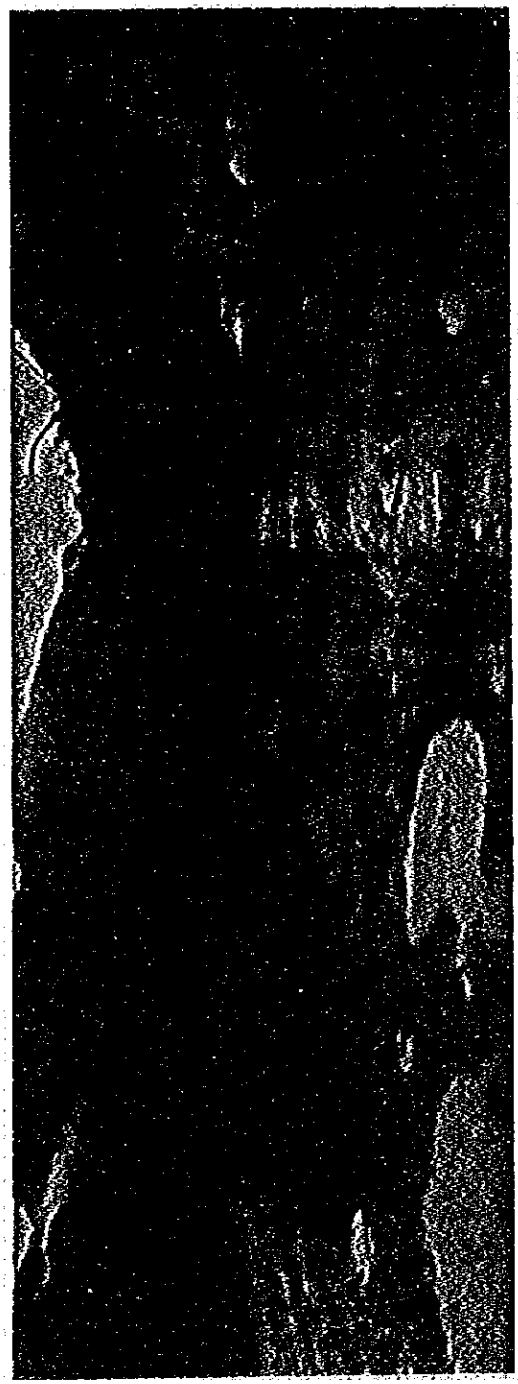


Fig. 25-B

PAIS PERU	CARACTERISTICA DE LA MARCA Disco de Bronce de 9 cms.	DESIGNACION K 349 135
PROVINCIA, ESTADO, O DEPARTAMENTO HUANUCO	ESTABLECIDA POR (ORGANIZACION) IGM	ELEVACION 652. 4455 (M)
MUNICIPIO, COMUNA, O CANTON	ORGANIZACION (FUNDIDA EN LA MARCA) SGIA	ORDEN
LINEA CERRP DE ASCP-PUCALLPA	ESTAMPADA K 349 IOM 1959 PERU	DATUM

A lo largo de la carretera Oerro de Pasco-Pucallpa, entre los pueblos de Huánuco y Tingo María partiendo de la Iglesia Evangélica de T. María el monumento está al NE a 0.5 Mi. situado sobre la Plaza Mcal. Castilla. Está al costado O. a 4.15 mts. del eje de la carretera y sa 0.20 mts. mas alto del nivel del terreno que la circunda.

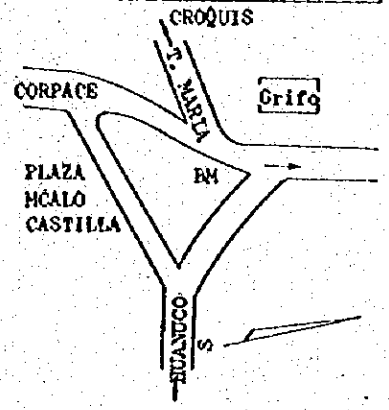
Desde la esquina S. de un grifo con azimut magnético 170° está a 14.60 mts., desde un poste de alumbrado pública con azimut magnético 190° está a 13.80 mts. y desde el cruce de ejes de las calles lera. y Miró Quesada con azimut 215° está a 48.20 mts.

Desde la marca el eje de la carretera a 30 mts. NE está 0.0 mts. a 30 S. está 0.0 mts. y frente a la marca 0.0 mts.

El terreno alrededor es plano.

La fotoidentificación es practicable.

CROQUIS



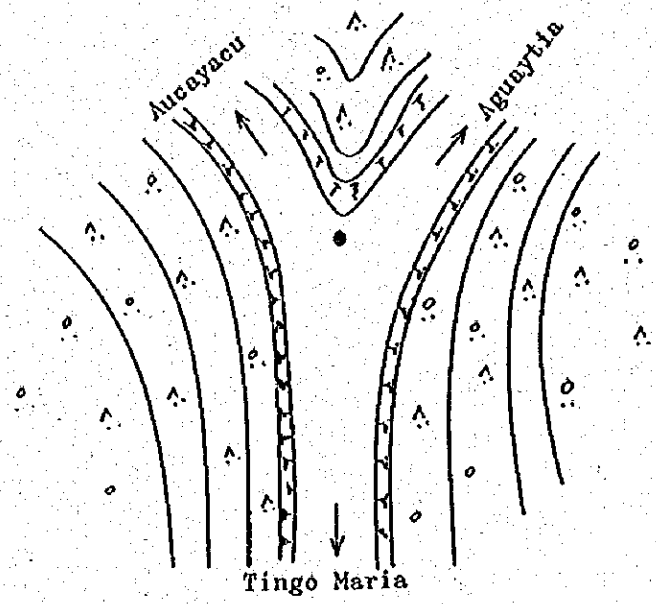
JUNIO 1959

Fig. 26 ILLUSTRATION OF STATION

Location of station Desvio Elevation H = 659.59 m

Huanuco-Tingo Maria-Aucayacu

Illustration



Photograph

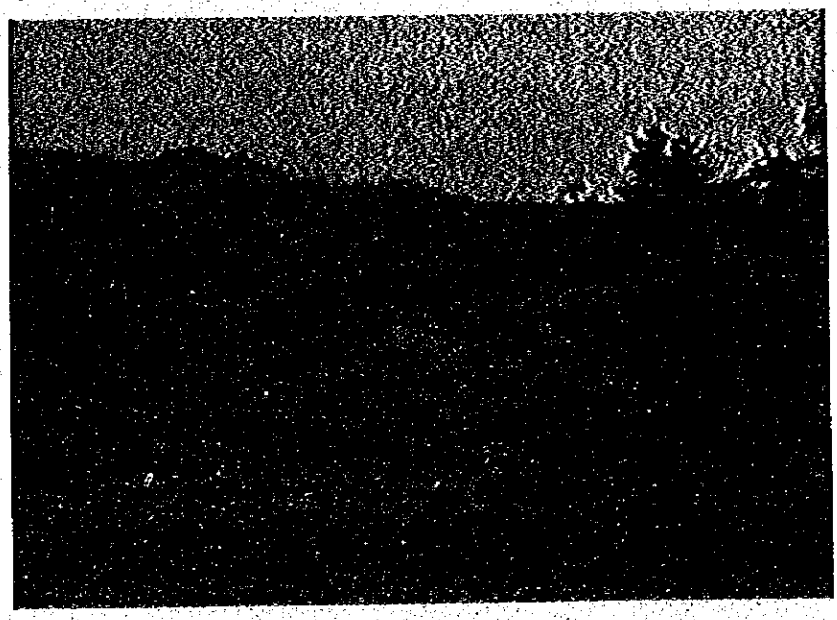


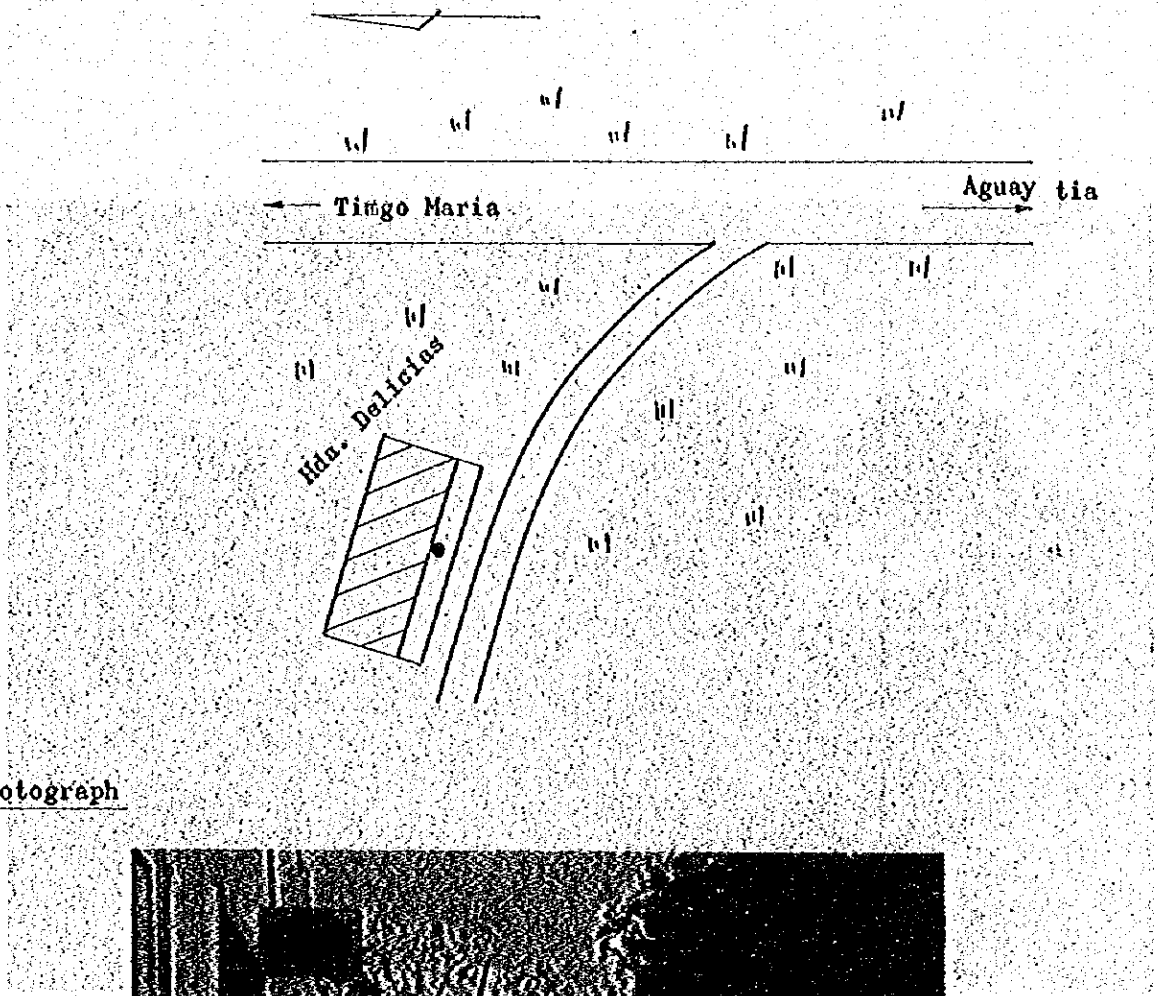
Fig. 27-A

ILLUSTRATION OF STATION

Location of station Hda. Delicias Elevation H = 888.81 m

Huanuco-Tingo Maria-Leoncioprado

Illustration



Photograph

Fig. 27-B

COUNTRY PERU	TYPE OF MARK Incrustado Disco de Bronce de 9 cms.	DESIGNATION OF MARK 151
PROVINCE, STATE OR DEPARTMENT SAN MARTIN	ESTABLISHED BY (AGENCY) I.G.M.	ELEVATION 888.8102
MUNICIPALITY, COMMUNITY OR REGION	AGENCY (CAST IN MARK) S.G.I.A.	ORDER (FINAL) (PRELIM.)
LINE CERRO DE PASCO - PUCALIPA	MARK IS STAMPED B 350 IGM 1959 PERU	DATUM

DESCRIPTION

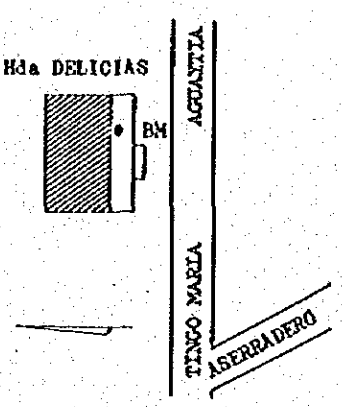
A lo largo de la carretera Cerro de Pasco-Pucallpa, entre los pueblos de Tingo María y Aguaytía, partiendo de la Iglesia Evangélica de Tingo María la marca está hacia el E. a 17.8 Mi. incrustada sobre la verada de una casa de 12,0 mts. de largo por 1.80 mts. de ancho y a 0.20 mts. sobre el téreno. Desde el borde E. de la vereda la marca está al O. a 5.0 mts. y desde el extremo O. de la misma vereda está al E. a 7.0 mts. Está al costado N. a 7.80 mts. del eje de la carretera y a 0.0 mts. del nivel del terreno que lo circunda.

Desde la entrada de la casa con azimut magnético 95° está a 1.10 mts.; desde la esquina E. de la misma casa con azimut magnético 275° está a 5.0 mts. y desde la intersección con un desmio al aserradero con azimut 70° está a 20.70 mts.

Desde la marca el eje de la carretera a 30 mts. al E. esta 1.0 mts. más alto, a 30 al O. está 1.0 mts. más bajo y frente a la marca 0,0 mts.

El terreno alrededor es pendiente.

La fotoidentificación es practicable.



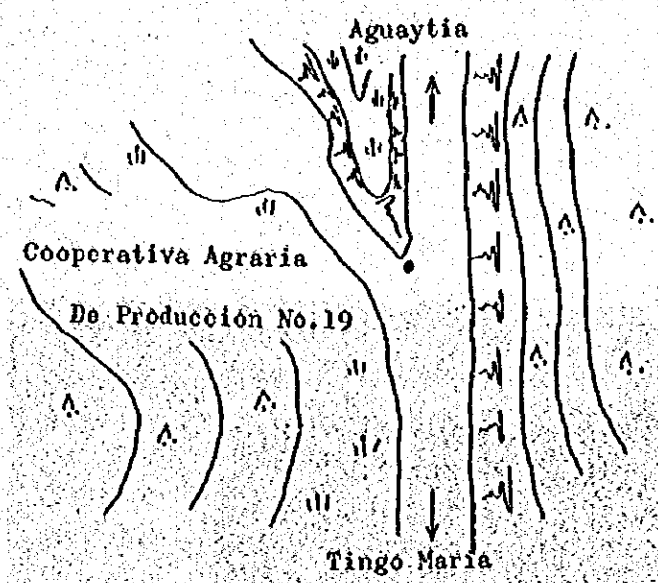
JUNIO 1959

Fig. 28 ILLUSTRATION OF STATION

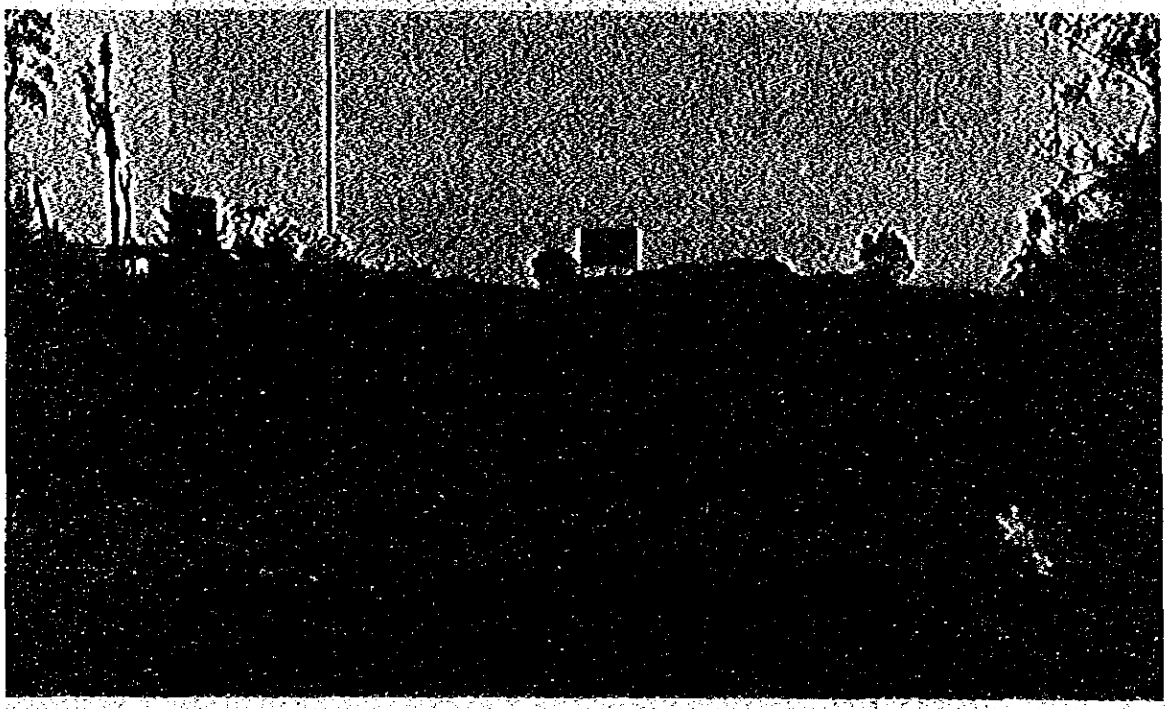
Location of station Desvio Elevation H = 1688.88 m

Huanuco-Leoncio Prado-Hermilio Valdizan

Illustration



Photograph



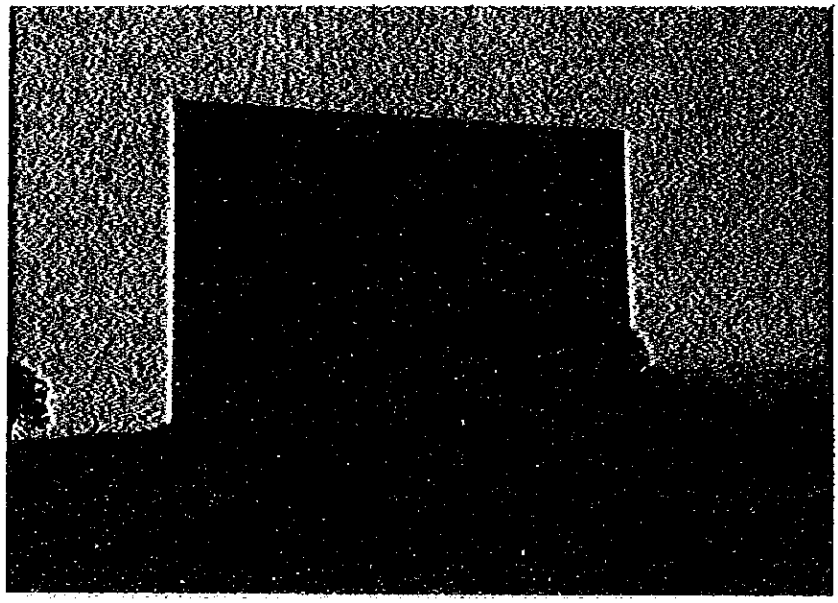
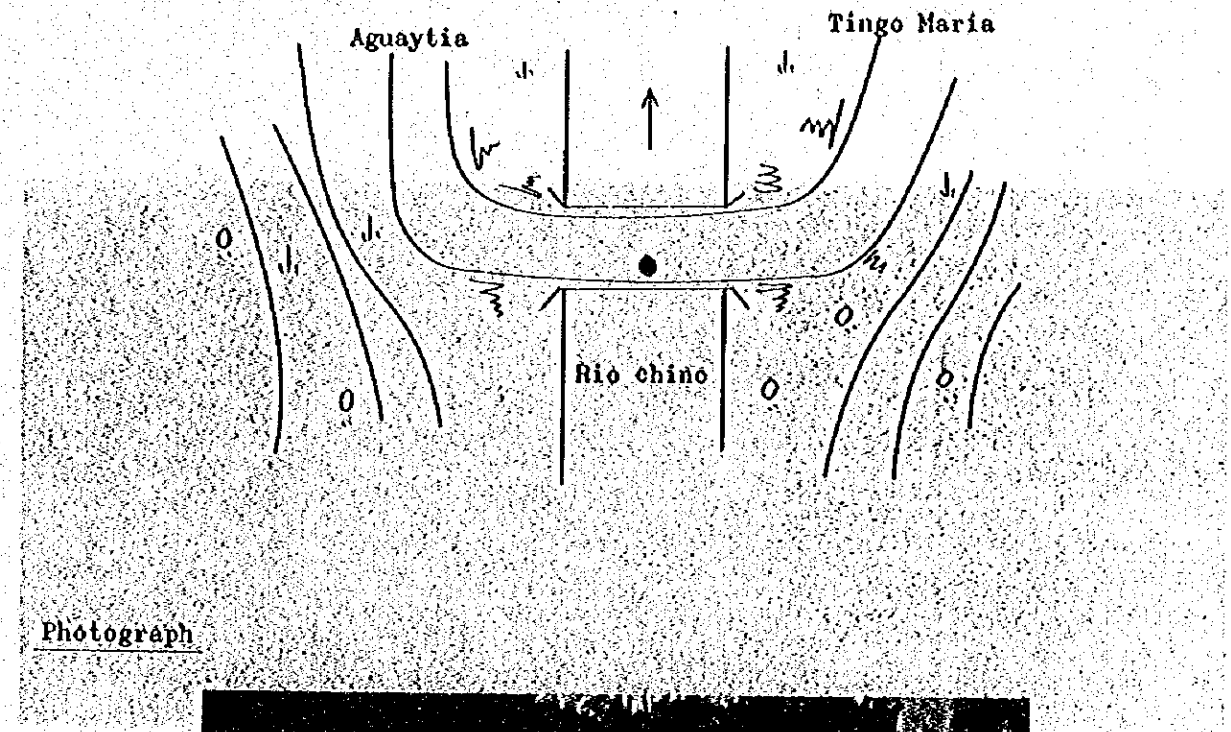


Fig. 29 ILLUSTRATION OF STATION

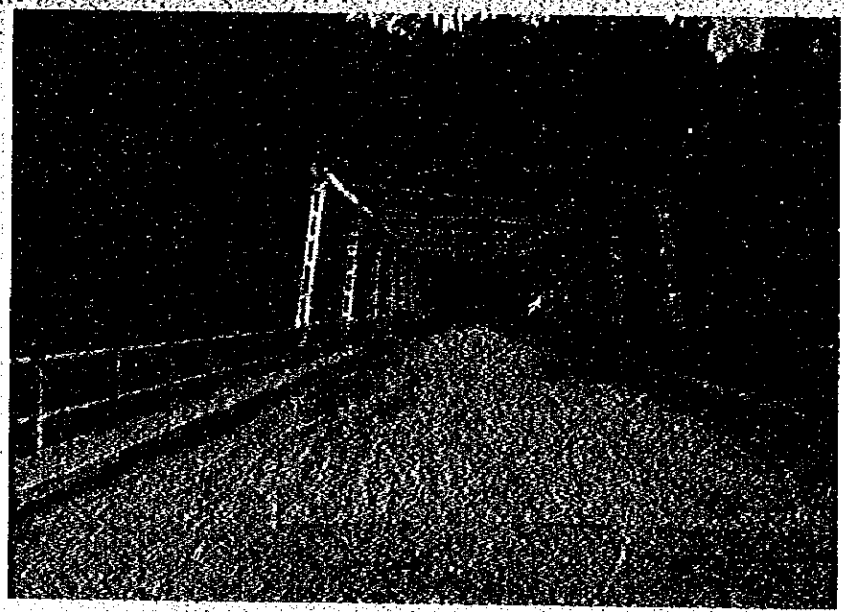
Location of station Pto Rio Chino Elevation H = 1126.96 m

Loreto-Padre-Aguaytia

Illustration



Photograph



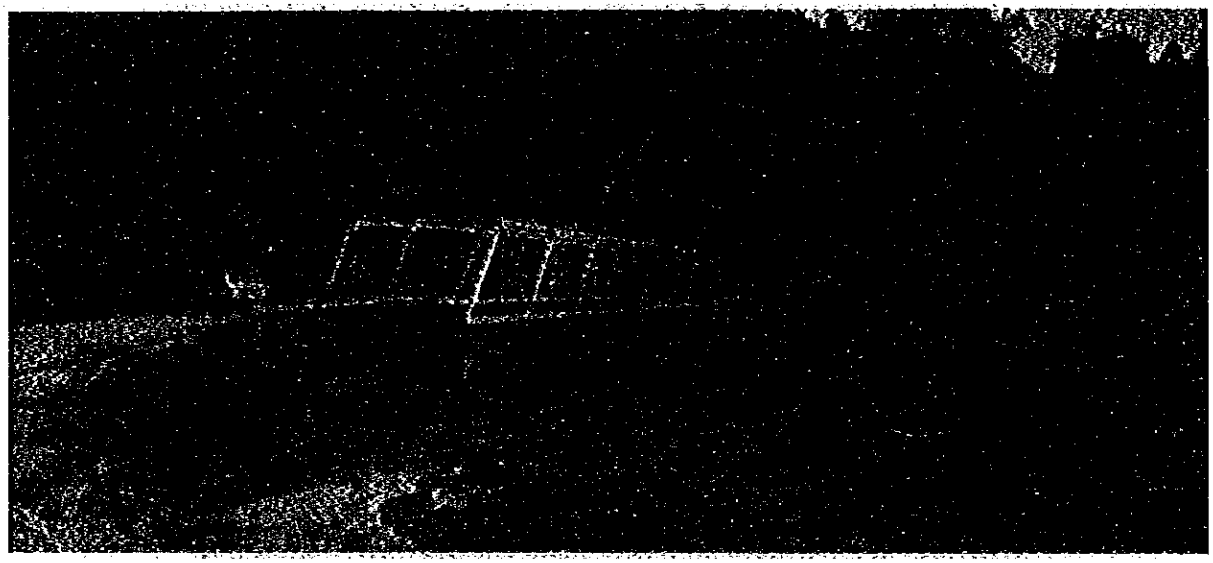
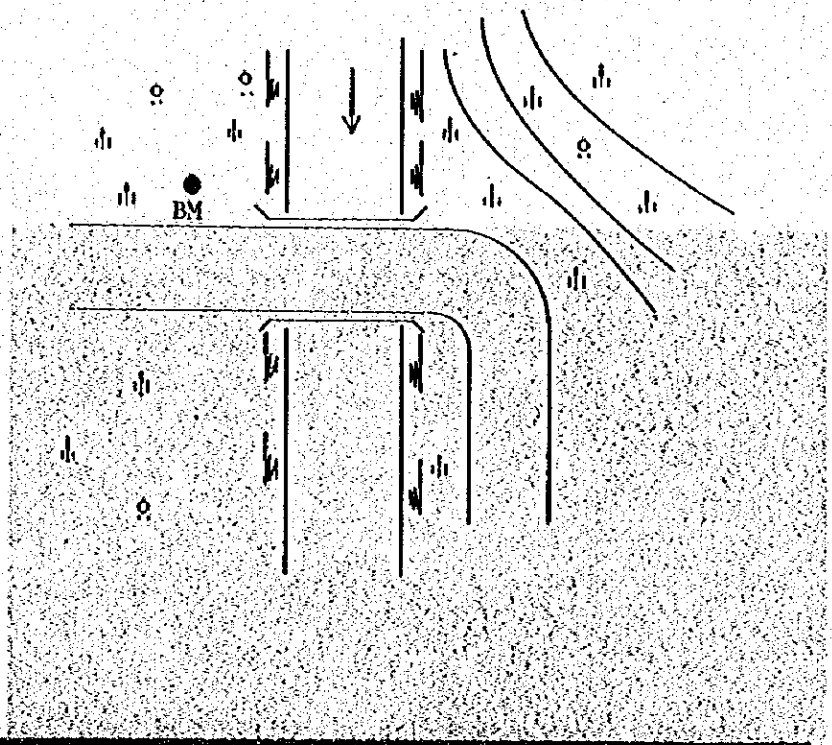


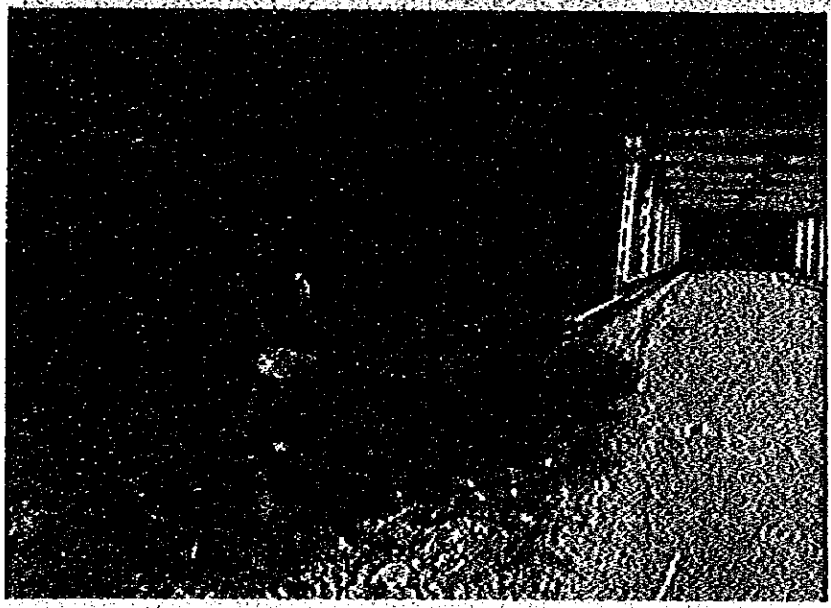
Fig. 30 ILLUSTRATION OF STATION

Location of station Pte. Previsto Elevation H = 524,954 m

Illustration



Photograph



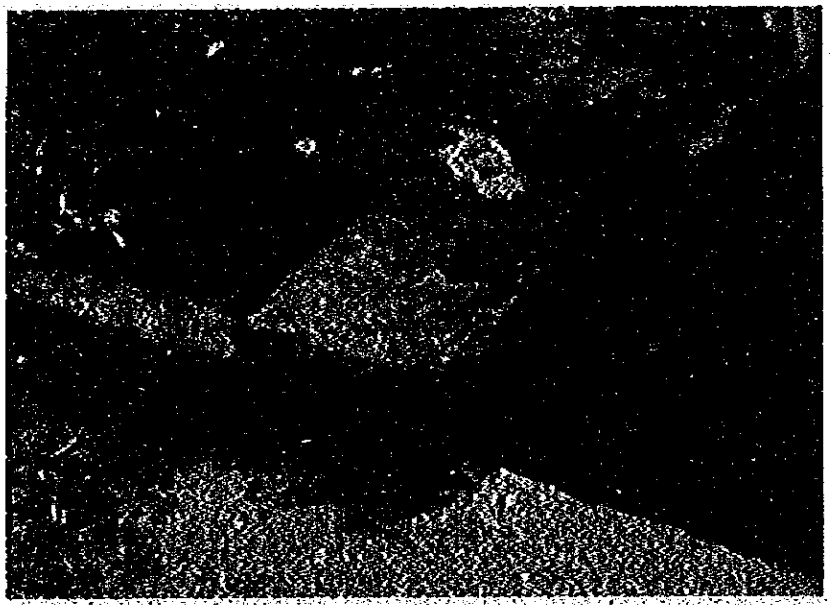


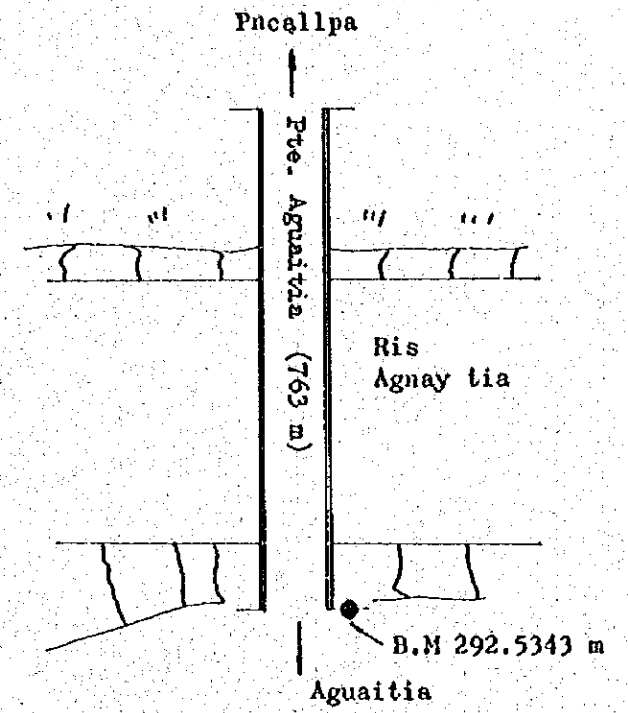
Fig. 31-A

ILLUSTRATION OF STATION

Location of station Pte. Aguaytia Elevation H = 292.53 m (B.M)

Huanuco-Tingo Maria-Aguaytia

Illustration



Photograph

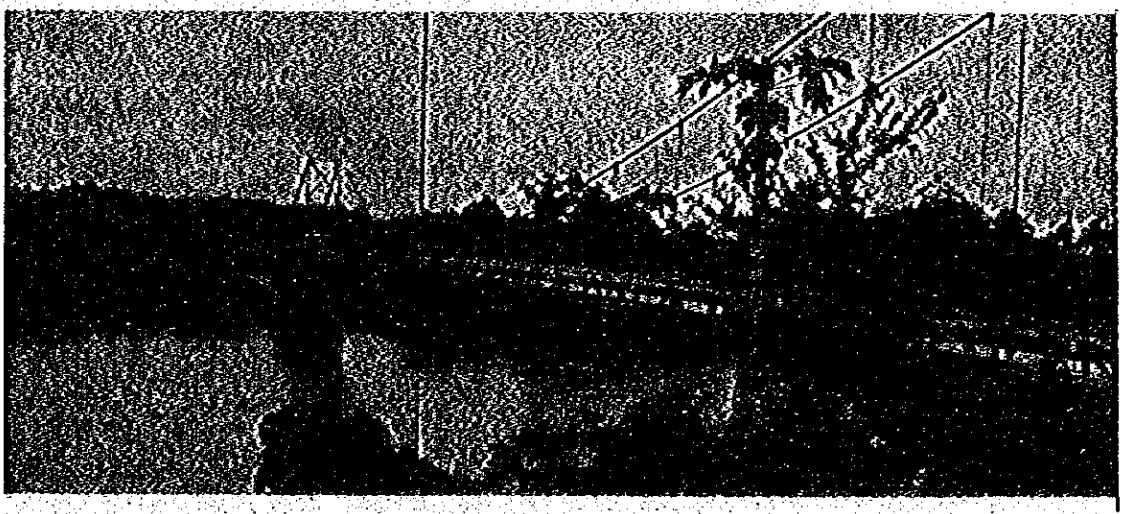
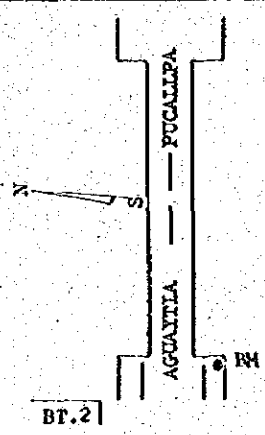


Fig. 31-B

COUNTRY	TYPE OF MARK	DESIGNATION OF MARK
PERU	Disco de Bronce de 9 cms.	196
PROVINCE, STATE OR DEPARTMENT	ESTABLISHED BY (AGENCY)	ELEVATION
LORETO	I.G.M.	292.5343 (FEET) (M)
MUNICIPALITY, COMMUNITY OR REGION	AGENCY (CAST IN MARK)	ORDER
	S.C.I.A.	(FINAL) (PRELIM.)
LINE	MARK IS STAMPED	DATUM
CERRO DE PASCO-PUCALLPA	Y 351 IGM 1959 PERU	

DESCRIPTION

A lo largo de la carretera Cerro de Pasco-Pucallpa, entre los pueblos de Tingo María y Aguaytía, partiendo de el puete de la Aguaytía la marca está hacia el NE. a 0.0 Mi. incrustada sobre el estribo SO. del puente Aguaytía de 763.0 mts. de largo por 5.0 mts. de ancho y a 15.0 mts. sobre el río Huallage. Desde el borde NE. del estribo la marca está al SO. a 13.0 mts. y desde el borde SO. del mismo estribo esta al NE. a 2.0 mts. Esta al costado SE. a 4.10 mts. del eje de la carretera y a 0.0 mts. del nivel del terreno que lo circunda.



JULIO 1959

Desde un pilar de fierro con azimut magnético 165° está a 1.40 mts., desde la esquina E. del campamento del B.T.-2 con azimut magnético 125° está a 32.50 mts. y desde los cables de soportes del puente con azimut magnético 75° está a 53.10 mts.

Desde la marca el eje de la carretera a 30 mts. al NE. está 0.0 mts., a 30 al SO. está 0.0 mts. y frente a la marca 0.0 mts.

El terreno alrededor es plano.

La fotoidentificación es practicable.

CALCULATION OF ELEVATION

Table I-2

12-Feb-1976

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT TEMP °F	TEMP. ADJUSTMENT SUM of TEMP	TEMP. ADJUSTMENT CT	ICT	HOUR			CR	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	San Ramon (B.M)	822		77			0	8.53			-6.1	815.9	+4.63	820.53		1
			-7		53	-0.4										
2	Pte. San Ramon	815		76			-0.4	9.02			-9.2	805.4	+3.90	809.30		2
			-55		52	-2.9										
3	La Merced	780		76			-3.3	9.33			-9.0	767.7	+1.43	769.13		3
			-31		52.5	-1.7										
4	Pte. Romilda	749		76.5			-5.0	10.05			-8.3	735.7	-1.20	734.50		4
			-19		53	-1.0										
5	Pte. Corolado	730		76.5			-6.0	10.23			-9.2	714.8	-2.66	712.14		5
			+33		54.5	+1.8										
6	San Luis	763		78			-4.2	10.58			-11.0	747.8	-5.50	742.30		6
			+57		59	+3.4										
7	Paucartambo	820		81			-8.0	12.05			-19.2	800.0	-10.92	789.08		7
			+22.5		62.5	+1.4										
8	Pte. Paucartambo	842.5		81.5			+0.6	13.50			-38.3	804.8	-19.43	785.37		8
			-48.5		65.5	-3.2										
9	San Luis	794		84			-2.6	14.15			-45.0	746.4	-21.45	724.95		9
			-22		68	-1.5										
10	Pte. Corolado	772		84			-4.1	14.42			-52.5	715.4	-23.64	691.76		10
			+61		70.5	+4.3										
11	La Merced	833		86.5			+0.2	15.03			-57.5	775.7	-25.34	750.36		11
			+65		70.5	+4.6										
12	Pte. San Ramon	898		84			+4.8	15.27			-63.5	839.3	-27.28	812.02		12
			+10		69.5	+0.7										
13	San Ramon (B.M)	908		85.5			+5.5	15.39			-65.0	848.5	-27.97	820.53	(0.081)	13

CALCULATION OF ELEVATION

Table V-3

13-Feb-1976 (A)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP °F	TEMP. ADJUSTMENT SUM of TEMP	TEMP. ADJUSTMENT CT	ΣCT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	San Ramon (B.M)	817.5		77			0	8.20				817.5	+3.03	820.53		1
			-7.5		54	-0.4										
2	Pte. San Ramon	810		77			-0.4	8.27				809.6	+2.56	812.16		2
			-58		54.5	-3.2										
3	La Merced	752		77.5			-3.6	8.52				748.4	+0.89	749.29		3
			-57		58	-3.3										
4	Pte. Corolado	695		80.5			-6.9	9.13				688.1	-0.52	687.58		4
			-95		62.5	-6.0										
5	Boca Tigre	600		82			-12.9	10.19				487.1	-4.99	582.11		5
			+229		72	+16.5										
6	San Ramon (B.M)	829		90			+3.6	12.04				832.6	-12.07	820.53		6

CALCULATION OF ELEVATION

Table I-4

13-Feb-1976 (B)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT TEMP °F	SUM of TEMP	CT	ΣCT	HOUR	CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	San Ramon (B.M)	821		77			0	8.18		821.0	-0.47	820.53		1
			-8.5		54	-0.5								
2	Pte. San Ramon	812.5		77			-0.5	8.30		812.0	-2.29	811.71		2
			-64		61	-4								
3	La Merced	748.5		84			-4.5	8.50		744.0	+0.01	744.01		3
			-53		67	-3.6								
4	Pte. Corolado	695.5		83			-8.1	9.15		687.2	+0.39	687.29		4
			-99		71	-7								
5	Boca Tigre	596.5		88			-15.1	10.15		581.4	+1.29	582.69		5
			+224		80	+18								
6	San Ramon (B.M)	820.5		92			+2.9	12.05		817.6	+2.93	820.53		6

Table I-5

CALCULATION OF ELEVATION

14-Feb-1976 (A)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT TEMP °F	TEMP. ADJUSTMENT SUM of TEMP	TEMP. ADJUSTMENT CT	ΣCT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	San Ramon (B.M)	819		75			0	8.23				819.0	+1.53	820.53		1
			+318		54.5	+17.3										
2	Churmazu	1,137		79.5			+17.3	11.27				1,154.3	-20.74	1,133.56		2
			+653		58.5	+38.2										
3	Oxapampa (B.M)	1,790		79			+55.5	12.55				1,845.5	-31.96	1,813.54		3

Table I-6

CALCULATION OF ELEVATION

14-Feb-1976 (B)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT: TEMP °F	TEMP. ADJUSTMENT: SUM of TEMP	TEMP. ADJUSTMENT: CT	ΣCT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	San Ramon (B.M)	818.5		71			0	8.35				815.5	+2.03	820.53		1
			+351.5		+49	+17.2										
2	Churmazu	1,140		78			+17.2	11.25				1,157.2	-19.56	1,137.64		2
			+651.0		+55	+35.8										
3	Oxapampa (B.M)	1,791		77			+53.0	12.50				1,844.0	-30.46	1,813.54		3

Table I-7

CALCULATION OF ELEVATION

15-Feb-1976 (A)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT: TEMP °F	TEMP. ADJUSTMENT: SUM of TEMP	TEMP. ADJUSTMENT: CT	ΣCT	HOUR			CS	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	Oxapampa	1,821		81.5	58.5	+1.8	0	14.05				1,821	-7.46	1,813.54		1
2	Chontabamba	1,852	+31	77	49	-0.3	+1.8	16.15				1,853.8	-23.48	1,830.32		2
3	Chontabamba	1,846.5	-5.5	72	47	-0.3	+1.5	16.33				1,848.0	-25.66	1,822.34		3
4	Oxapampa	1,840.5	-6.0	75			+1.2	16.53				1,841.7	-28.16	1,813.54		4

Table I-8

CALCULATION OF ELEVATION

15-Feb-1976 (B)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT TEMP °F	TEMP. ADJUSTMENT SUM of TEMP	TEMP. ADJUSTMENT CT	ΣCT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	Oxapampa	1,817.5		78			0	14.10				1,817.5	-3.96	1,813.54		1
			+35.3		+50	+1.8										
2	Chontabamba	1,853.0		72			+1.8	16.15				1,854.8	-20.96	1,833.84		2
			-6.5		+43.5	-0.3										
3	Chontabamba	1,846.5		71.5			+1.5	16.30				1,848.0	-23.00	1,825.00		3
			-8.5		+46.5	-0.4										
4	Oxapampa	1,838.5		75.0			+1.1	16.52				1,839.0	-26.06	1,813.54		4

CALCULATION OF ELEVATION

Table I-9

16-Feb-1976 (A)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT TEMP °F	TEMP. ADJUSTMENT SUM of TEMP	TEMP. ADJUSTMENT CT	ΣCT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	Oxapampa	1.799		71			0	9.17				1,799	+14.54	1,813.54		1
			-43		47	-2.0										
2	Pallamazu	1.756		76			-2.0	10.03				1,755.8	+11.09	1,766.89		2
			-11		48	-0.5										
3	Huancabamba	1.745		72			-2.5	11.02				1,742.5	+6.66	1,749.16		3
			-307.5		45	-13.8										
4	Rio Tunqui	1.437.5		73			-16.3	12.28				1,421.2	+0.29	1,421.49		4
			+381.5		47	+17.9										
5	Quillazu	1.819		74			+1.6	14.53				1,820.6	-10.66	1,809.94		5
			+8.0		46	+0.4										
6	Oxapampa	1.827		72			+2.0	15.29				1,827.0	-13.46	1,813.54		6

CALCULATION OF ELEVATION

Table I-10

16-Feb-1976 (N)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT TEMP °F	TEMP. ADJUSTMENT SUM of TEMP	TEMP. ADJUSTMENT CT	ICT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	Oxapampa	1,799		70.5	46.5	-1.95	0	9.15				1,799.0	+14.54	1,813.54		1
2	Pallamazu	1,757	-42.0	76.0	48.0	-0.70	-1.95	10.00				1,755.05	+10.58	1,765.63		2
3	Huancabamba	1,742.5	-14.5	72.0	45.0	-13.75	-2.65	11.00				1,739.85	+5.30	1,745.15		3
4	Rio Tunqui	1,437.0	-305.5	73.0	48.0	+18.38	-16.40	12.15				1,420.60	-1.30	1,419.30		4
5	Quillazu	1,820.0	+383.0	75.0	48.0	+0.43	+1.98	14.50				1,821.98	-14.94	1,807.04		5
6	Oxapampa	1,829.0	+9.0	73.0			+2.41	15.22				1,831.41	-17.87	1,813.54		6

CALCULATION OF ELEVATION

Table I-11

17-Feb-1976 (A)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT TEMP °F	TEMP. ADJUSTMENT SUM of TEMP	TEMP. ADJUSTMENT CT	ICT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	Oxapampa (B.M)	1,800		71			0	90.6				1,800	+13.54	1,813.54		1
			-855		51.5	-44.0										
2	Churmazu	945		80.5			-44.0	10.44				901	+4.52	905.52		2
			-65		68.5	-4.5										
3	San Ramon (B.M)	880		88			-48.5	13.15				831.50	-10.87	820.53		3

CALCULATION OF ELEVATION

Table I-12

17-Feb-1976 (E)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT TEMP °F	TEMP. ADJUSTMENT SUM of TEMP	TEMP. ADJUSTMENT CT	ΣCT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	Oxapampa (B.M)	1,800		69.5			0	9.15				1,800	+13.54	1,813.54		1
			-860		+50.0	-43.0										
2	Churmazu	940		80.5			-43.00	10.42				897	+6.67	903.67		2
			-67		+69.5	-4.66										
3	San Ramon (B.M)	873		89.0			-47.66	13.13				825.34	-4.81	820.53		3

CALCULATION OF ELEVATION

Table I-13

18-Feb-1976 (A)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT: TEMP °F	TEMP. ADJUSTMENT: SUM of TEMP	TEMP. ADJUSTMENT: CT	ΣCT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	TARMA (B.M)	2,998.5		70			0	9.12				2,998.5	+52.77	3,051.27		1
			-313.5		35	-11										
2	PALCA	2.685.0		65			-11	9.47				2,674.0	+53.61	2,727.61		2
			-210.0		25	-6.7										
3	HUAYAUGNIU	2,415.0		60			-17.7	10.10				2,397.3	+54.16	2,451.46		3
			+582.0		28.5	+16.5										
4	TARMA (B.M)	2,997.0		68.5			-1.2	11.04				2,995.8	+55.47	3.051.27		4

Table I-14

CALCULATION OF ELEVATION

18-Feb-1976 (R)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP °F	TEMP. ADJUSTMENT SUM of TEMP	TEMP. ADJUSTMENT CT	ICT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	TARMA (B.M)	2,998.0		66			0	9.15				2,998.0	+53.27	3,051.27		1
			-310.5		+28	-8.69										
2	PALCA	2,687.5		62			-8.69	9.45				2,678.31	+51.26	2,729.57		2
			-270.5		+22.5	-6.09										
3	HUAYAUGNIU	2,417.0		60.5			-14.78	10.08				2,402.22	+49.72	2,451.94		3
			+583.5		+33.5	+19.55										
4	TARMA (B.M)	3,000.5		73			+4.77	11.03				3,005.27	+46.00	3,051.27		4

CALCULATION OF ELEVATION

Table I-15

19-Feb-1976 (A)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT: TEMP o#	TEMP. ADJUSTMENT: SUM of TEMP	TEMP. ADJUSTMENT: CT	ΣCT	HOUR			CE	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	TARMA (B.M)	3,050.0		61			0	8.05				3,050.0	+1.27	3,051.27		1
			+1,066.5		22.5	+24										
2	JUNIN	4,116.5		61.5			+24	9.45				4,140.5	-33.40	4,107.10		2
			-2,155.0		35.5	-76.5										
3	REPRESA YUNCAN	1,961.5		74			-52.5	15.52				1,909.0	-34.87	1,874.20		3
			+2,159.0		34.5	+74.5										
4	JUNIN (B.M)	4,120.5		60.5			+22	17.40				4,142.5	-35.40	4,107.10		4

CALCULATION OF ELEVATION

Table I-16

19-Feb-1976 (B)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT: TEMP °F	SUM of TEMP	CT	ΣCT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	TARMA (B.M)	3,046.5		62			0	8.03				3,046.5	+4.77	3,051.27		1
			+1,078.0		23.5	+25.3										
2	JUNIN	4,124.5		61.5			+25.3	9.49				4,149.8	-42.70	4,107.10		2
			-2,162.0		35.5	-76.7										
3	REPRESA YUNCAN	1,962.5		74			-51.4	15.50				1,911.1	-44.14	1,866.96		3
			+2,166.0		34.5	+74.7										
4	JUNIN (B.M)	4,128.5		60.5			+23.3	17.43				4,151.8	-44.70	4,107.10		4

Table I-17

CALCULATION OF ELEVATION

21-Feb-1976 (A)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT TEMP °F	TEMP. ADJUSTMENT SUM of TEMP	TEMP. ADJUSTMENT CT	ICT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	HUANUCO	1,900.5		69			0	9.03				1,900.5	-0.50	1,900.00		1
			+793.5		38	+30.2										
2	UMARI	2,694.0		69			+30.2	11.37				2,724.2	-12.05	2,712.15		2
			-768.0		46	-35.3										
3	HUANUCO	1,926.0		77			-5.1	13.32				1,920.8	-20.80	1,900.00		3

Table I-18

CALCULATION OF ELEVATION

21-Feb-1976 (B)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT TEMP °F	TEMP. ADJUSTMENT SUM of TEMP	TEMP. ADJUSTMENT CT	ΣCT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	HUANUCO	1,897.0		68			0	9.05				1,897.0	+3.00	1,900.00		1
			+793		37	+29.3										
2	UMARI	2,690.0		69			+29.3	11.35				2,719.3	-7.50	2,711.80		2
			-769		46	-35.3										
3	HUANUCO	1,921.0		77			-6.0	13.34				1,915.0	-15.00	1,900.00		3

CALCULATION OF ELEVATION

Table I-19

22-Feb-1976 (A)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT TEMP °F	TEMP. ADJUSTMENT SUM of TEMP	TEMP. ADJUSTMENT CT	ΣCT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	TINGO MARIA (B.M)	649.0		78			0	12.48				649.00	+3.45	652.45		1
			+68.5		54.5	+3.7										
2	LAS PALMAS	717.5		76.5			+3.7	13.16				721.20	+1.38	722.58		2
			+53.5		52.5	+2.8										
3	PTE. CAYUMBA G.	771.0		76			+6.5	13.33				777.50	+0.12	777.62		3
			-116.0		53.0	-6.1										
4	TINGO MARIA (B.M)	655.0		77			+0.4	14.15				655.40	-2.95	652.45		4

Table I-20

CALCULATION OF ELEVATION

22-Feb-1976 (B)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT TEMP °F	TEMP. ADJUSTMENT SUM of TEMP	TEMP. ADJUSTMENT CT	ICT	HOUR			CS	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	TINGO MARIA (B.M)	649.0		78			0	12.46				649.00	+3.45	652.45		1
			+68.5		55	+3.7										
2	LAS PALMAS	717.5		77			+3.7	13.15				721.20	+1.13	722.33		2
			+57.0		53	+3.0										
3	PTE. CAYUMBA G.	774.5		76			+6.7	13.30				781.20	+0.07	781.27		3
			-119.0		53.5	-6.3										
4	TINGO MARIA (B.M)	655.5		77.5			+0.4	14.12				655.90	-3.45	652.45		4

CALCULATION OF ELEVATION

Table I-21

23-Feb-1976 (A)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP. ADJUSTMENT TEMP °F	SUM of TEMP	CT	ICT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	TINGO MARIA (B.M)	650.0		77			0	8.08				650.0	+2.45	652.45		1
			+5.5		53	+0.3										
2	DESVIO	655.5		76			+0.3	8.37				655.8	+4.57	660.37		2
			+215.0		53	+11.4										
3	HDA. DELICIAS (B.M)	870.5		77			+11.7	9.05				882.2	+6.61	888.81		3
4	HDA. DELICIAS (B.M)	890.0		77			0	9.11				890.0	-1.1	888.81		4
			+760.0		54	+41.0										
5	DESVIO (Hermilio)	1,650.0		77			+41.0	9.53				1,691.0	-2.87	1,688.13		5
			-530.0		55	-29.1										
6	PTE. RIO CHINO	1,120.0		78			+11.9	10.19				1,131.9	-3.91	1,127.99		6
			-563.5		62	-34.9										
7	PTE. PREVISTO (NUEVO)	556.5		84			-23.0	11.03				533.5	-5.67	527.83		7
			-217.0		71	-15.4										
8	PTE. AGUAYTIA (B.M)	339.5		87			-38.4	12.13				301.1	-3.57	292.53		8
9	PTE. AGUAYTIA	295.5		89			0	13.30				295.5	-2.97	292.53		9
			+228.0		79	+18.0										
10	PTE. PREVISTO (ANTIGO)	523.5		90			+18.0	14.36				541.5	-16.55	524.95		10

Table I-21

CALCULATION OF ELEVATION

23-Feb-1976 (B)

STATION No.	STATION DESCRIPTION	READING	DIFF. of READ'S	TEMP °F	TEMP. ADJUSTMENT SUM of TEMP	TEMP. ADJUSTMENT CT	ICT	HOUR			CB	ELEVATION COMP.	CLOSURE CORREC.	ELEVATION ACTUAL	NOTE	No.
1	TINGO MARIA (B.M)	648.5		76			0	8.06				648.5	+3.95	652.45		1
			+5.5		52	+0.3										
2	DESVIO	654.0		76			+0.3	8.36				654.3	+4.50	658.80		2
			+218.0		52.5	+11.4										
3	HDA. DELICIAS (B.M)	872.0		76.5			+11.7	9.07				883.7	+5.11	888.81		3
4	HDA. DELICIAS (B.M)	890.0		77			0	9.09				890.0	-1.19	888.81		4
			+764.0		56	+42.8										
5	DESVIO (Hermilia)	1,654.0		78			+38.2	9.51				1,692.2	-2.58	1,689.62		5
			-533.0		56	-29.8										
6	PTE. RIO CHINO	1,121.0		78			+8.4	10.18				1,129.4	-3.47	1,125.93		6
			-562.5		62	-34.9										
7	PTE. PREVISTO (NUEVO)	558.5		84			-26.5	11.04				532.0	-4.99	527.01		7
			-216.5		71	-15.4										
8	PTE. AGUAYTIA (B.M)	342.0		87			-41.9	12.22				300.1	-7.57	292.53		8
9	PTE. AGUAYTIA	292.5		89.5			0	13.32				292.5	+0.03	292.53		9
			+227.5		80	+18.2										
10	PTE. PREVISTO (ANTIGO)	520.0		90.5			+18.2	14.34				538.2	-13.25	524.95		10