A.VI.2 Results of Various Tests and Analyses

A.VI.2.1 X-ray Diffraction

The evaporation residue of water at the lake shore was observed by polarizing microscope and was analyzed by X-ray diffraction. This was because it was thought that by learning about the ingredients, clues to the constituents of the lake water and the origin of the salts could be obtained.

According to the results of analyses, the sample is mainly diatom with small amounts of hornblende, plagioclase, quartz, chlorite, and sericite, and although these are not sediments of thermal spring water or solfataric atmosphere, it cannot be concluded by only such results that the origin of the salts has no relation with thermal spring water.

The method of analysis is as described below.

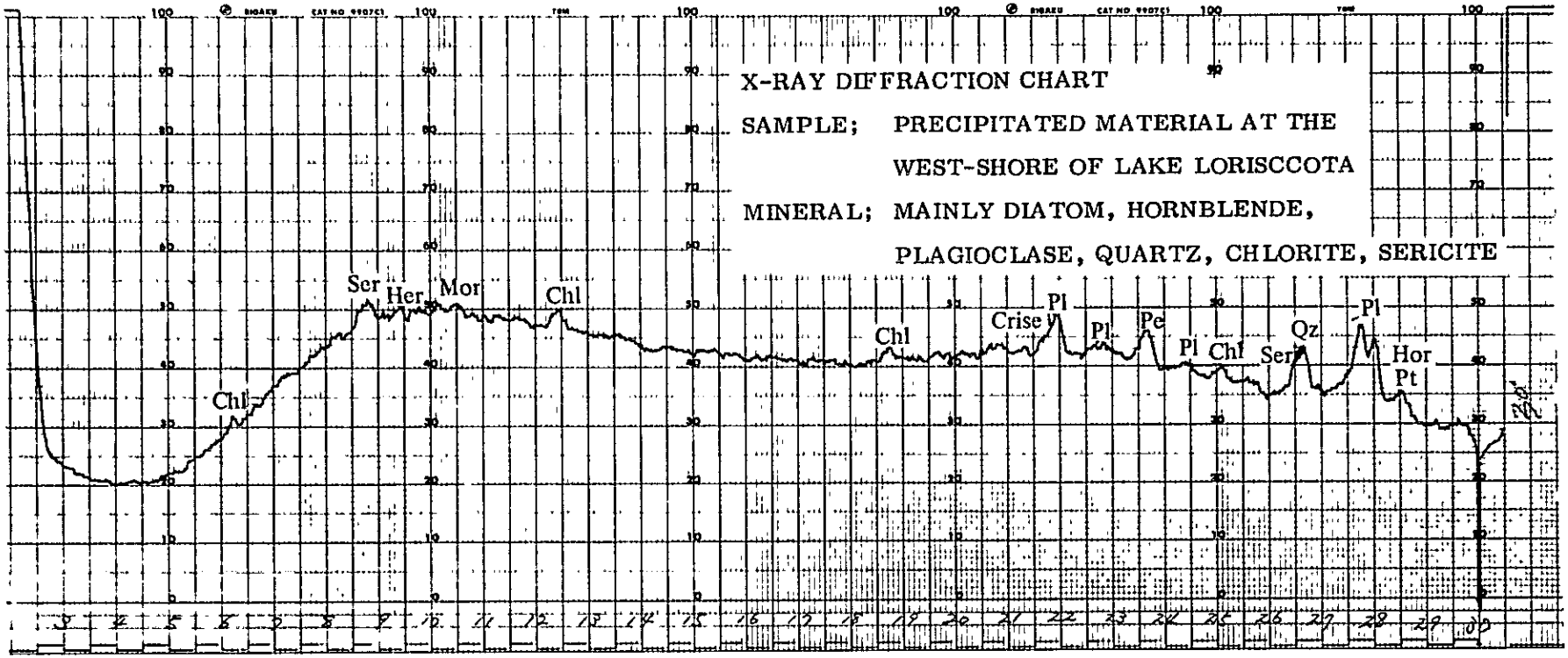
(1) A portion of the sample is examined by polarizing microscope.

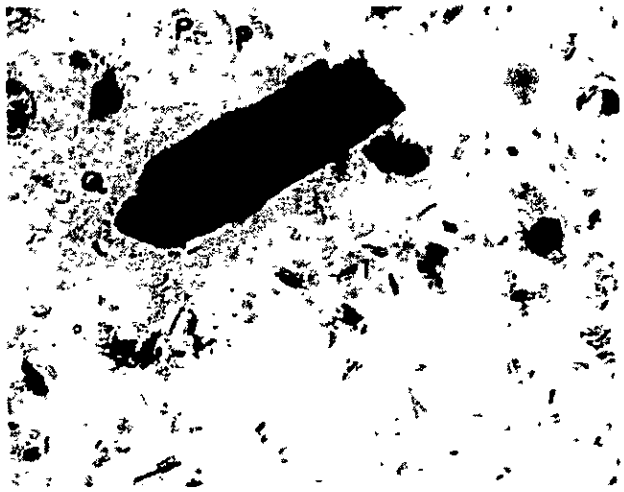
(2) Upon natural drying of the sample, it is coarsely crushed by a vibratory mill, further pulverized in an agate mortar, filled in an aluminum holder, and irradiated with X-rays.

The apparatus and the measurement conditions are as listed below.

Geiger Flex Model 2034 (Rigaku Denki Co.)

Target	Cu
Filter	Ni
Tube voltage	35 kV
Tube current	25 mV
Count, full scale	4,000 cps
Time constant	1 sec
Scanning speed	2°/min
Recording paper speed	2 cm/min
Slit	1°-0.3 mm -1°


X-RAY DIFFRACTION CHART
SAMPLE; PRECIPITATED MATERIAL AT THE
WEST-SHORE OF LAKE LORISCCOTA
MINERAL; MAINLY DIATOM, HORNBLENDE,
PLAGIOCLASE, QUARTZ, CHLORITE, SERICITE
Chl
Ser
Her
Mor
Chl
Chl
Crise
Pl
Pl
Pe
Pl
Chl
Ser
Qz
Pl
Hor
Pt



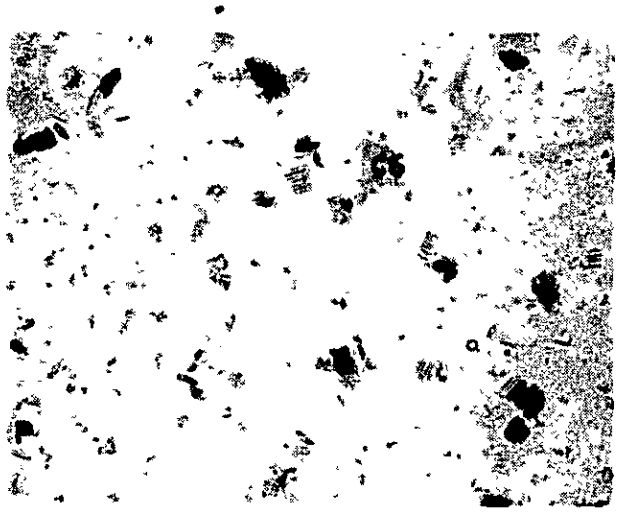
H : Hornblende

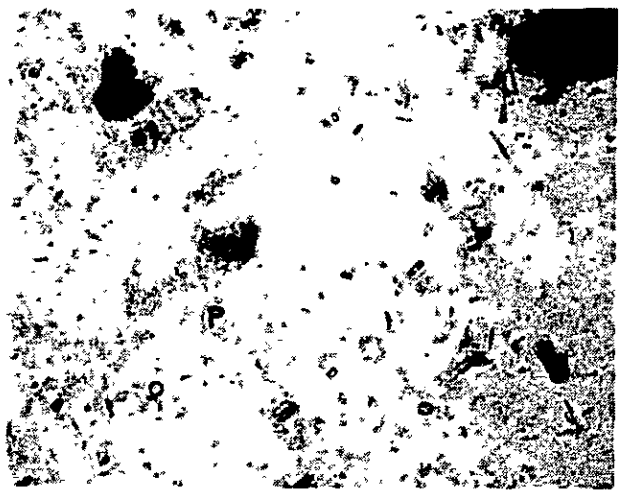
CS : Chlorite, Sericite

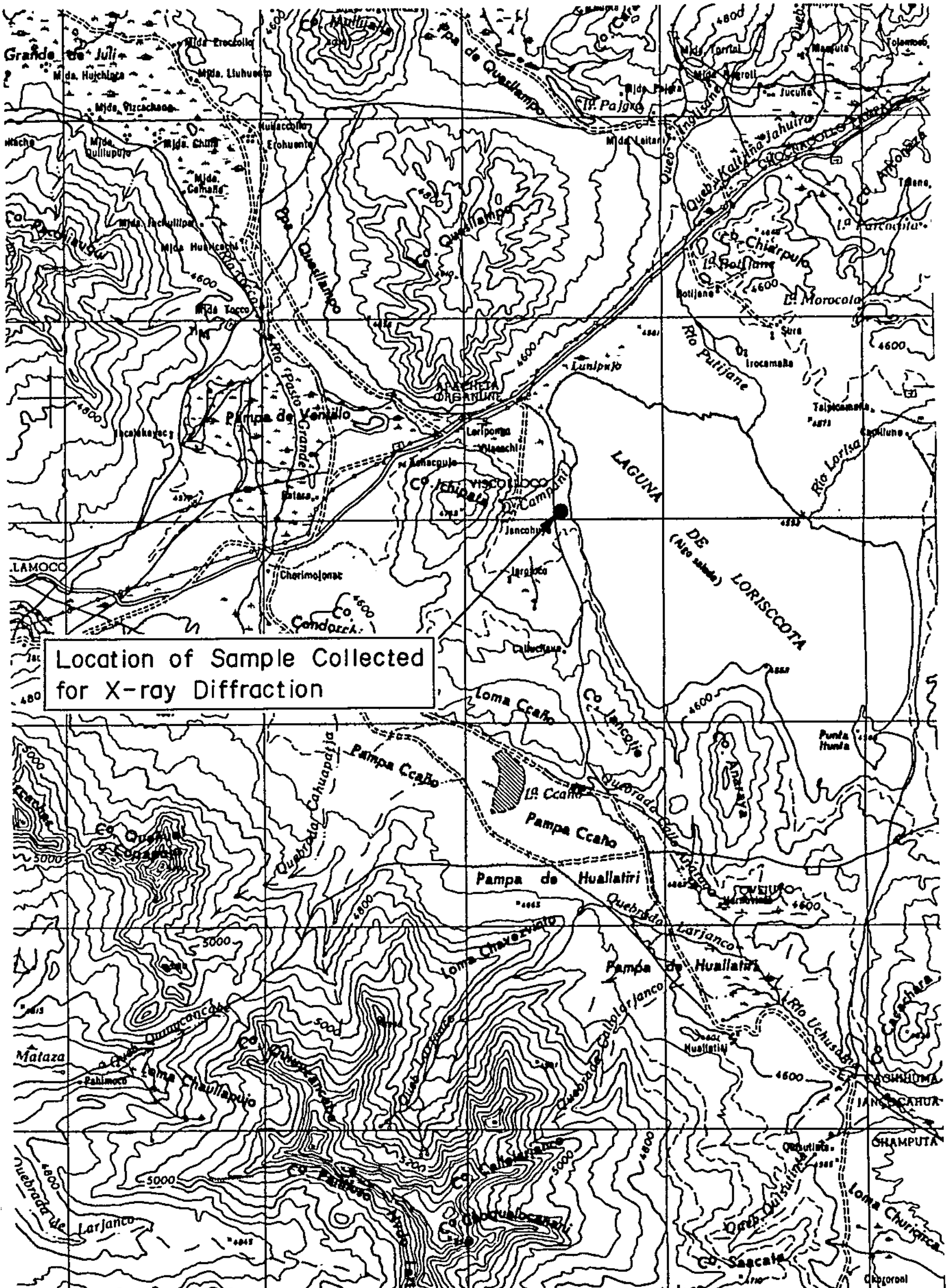
P : Plagioclase

Q : Quartz

Other component is a fragment of diatom





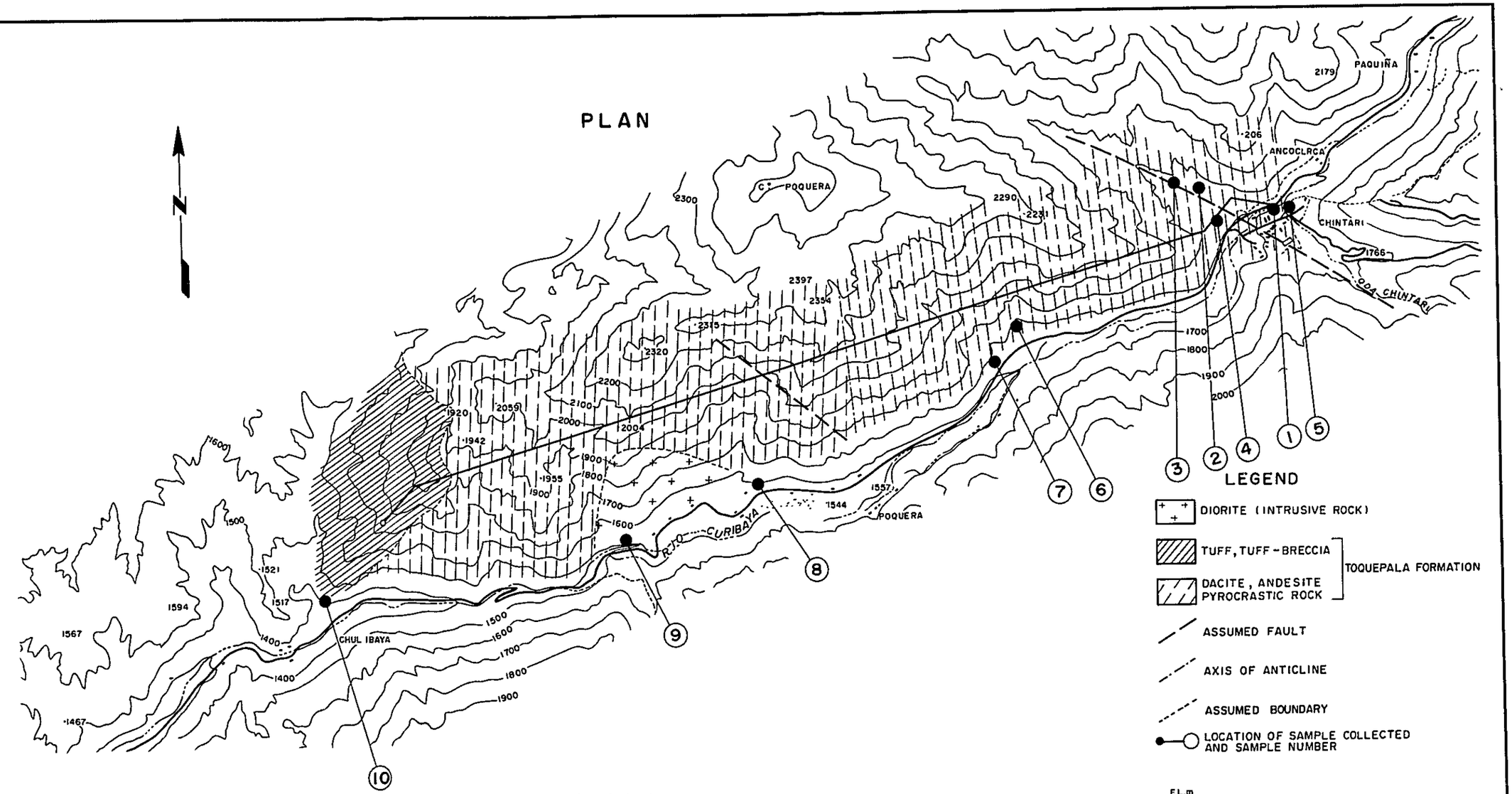

Location of Sample Collected
for X-ray Diffraction
LAGUNA
DE
LORISCCOTA
(Algo salada)
Pampa de Venillo
Pampa Ccaño
Pampa de Huallatiri
Loma Ccaño
Loma Chaullapujo
Loma Churiqna
Rio Putijane
Rio Larisa
Rio Uchusuma
Quebrada de Larjanco
Quebrada Cahuapalja
Co. Quellampo
Co. Saacata
Co. Jancolie
Lunipujo
Jancohuyo
Chachaputa
Mataza
Grande de Juli
5000
4800
4600
4600

A.VI.2.2 Rock Sample Microscope Observation

The results of microscope observations of 10 representative rock samples of this district are as shown in the table.

Slice No.	Sample No.	Date	Rock Name	Color	
1	821215-01	1982.12.15	Dacite	Reddish Purple	Phenocryst: Large amounts of quartz, plagioclase megacrysts, hornblende (pseudomorph: replaced by muscovite, iron oxide, calcite), weak and subjected to carbonation
2	821215-04	1982.12.15	Lapilli Tuff	Brown Grey	Scattered epidotic plagioclase and quartz in fluidal structure of fine-grained feldspar
3	821215-07	1982.12.15	Rhyolite	Brown - Pale Grey Brown	Phenocryst: Large amounts of quartz, plagioclase megacrysts Hornblende (calcitization + iron oxidization) Ground mass: Feldspar, quartz fine-grained assemblage (?)
4	821215-08	1982.12.15	Trachyte	Brown Grey	Plagioclase scattered in fluidal structure of feld-spar with plagioclase epidotic. Veins of quartz, calcite, almost no metamorphosis
5	B-2 10.10-10.20	1983.1.14	Dacite	Reddish Purple	Phenocryst: Quartz, plagioclase, potassium feldspar (?), hornblende (sericitization, iron oxidization), olivine (?) pseudomorph occurrence Fluidal structure, weak carbonation
6	821216-01	1982.12.16	Andesitic Tuff	Brown - Pale Grey Brown	Plagioclase (megacryst), quartz (small amount), opaque Fluidal structure, weak carbonation
7	821216-02	1982.12.16	Dacite	Greenish Grey	Phenocryst: Plagioclase, quartz, opaque, hornblende (partial sericitization, calcitization) Weak fluidal structure, slightly carbonated
8	821216-03	1982.12.16	Aphyric Basalt	Dark Grey	Phenocryst: Olivine (chloritic), plagioclase (albitic, epidotic), clinopyroxene (Ti-augite), spinel Weakly metamorphosed, chlorite, epidote formed
9	821103-02 821116-04 821120-01	1982.11.3 11.16 11.20	Diorite	Dark Blue Green	Holocrystalline, plagioclase + brownish-green horn-blende + opaque, fairly fresh
10	821103-01 821116-09	1982.11.3 11.16	Rhyolitic Tuff	Red brown	Plagioclase, quartz, hornblende (small amount), fluidal structure, weakly carbonated

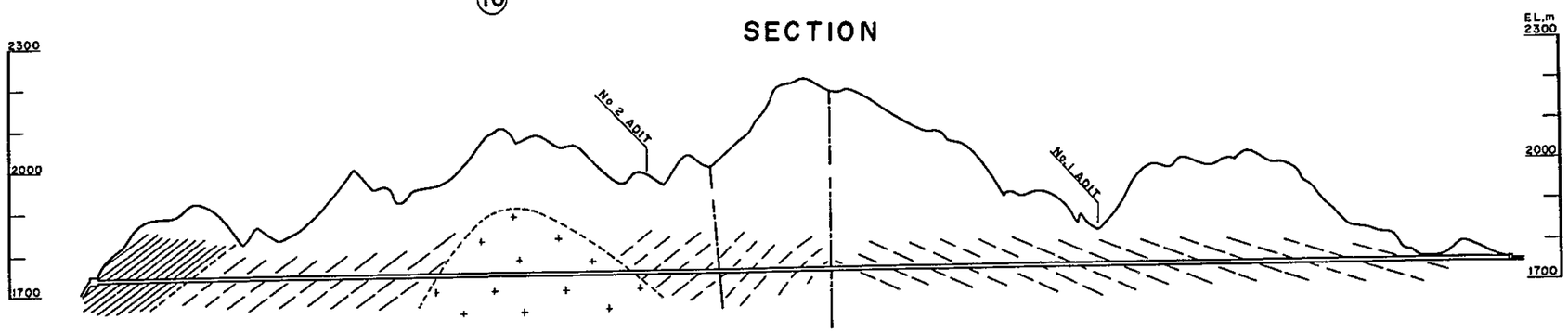
PLAN



LEGEND

- DIORITE (INTRUSIVE ROCK)
- TUFF, TUFF-BRECCIA
- DACITE, ANDESITE PYROCRASTIC ROCK
- TOQUEPALA FORMATION
- ASSUMED FAULT
- AXIS OF ANTICLINE
- ASSUMED BOUNDARY
- LOCATION OF SAMPLE COLLECTED AND SAMPLE NUMBER

SECTION



0 0.5 1.0 1.5km

WATER SUPPLY FOR THE LAKE ARICOTA AND ARICOTA No 3 PROJECT

ARICOTA NO.3 HYDROELECTRIC POWER
LOCATION OF SAMPLE COLLECTED FOR MICROSCOPE OBSERVATION

Dec. 1983

A.VI.2.3 Age Measurement

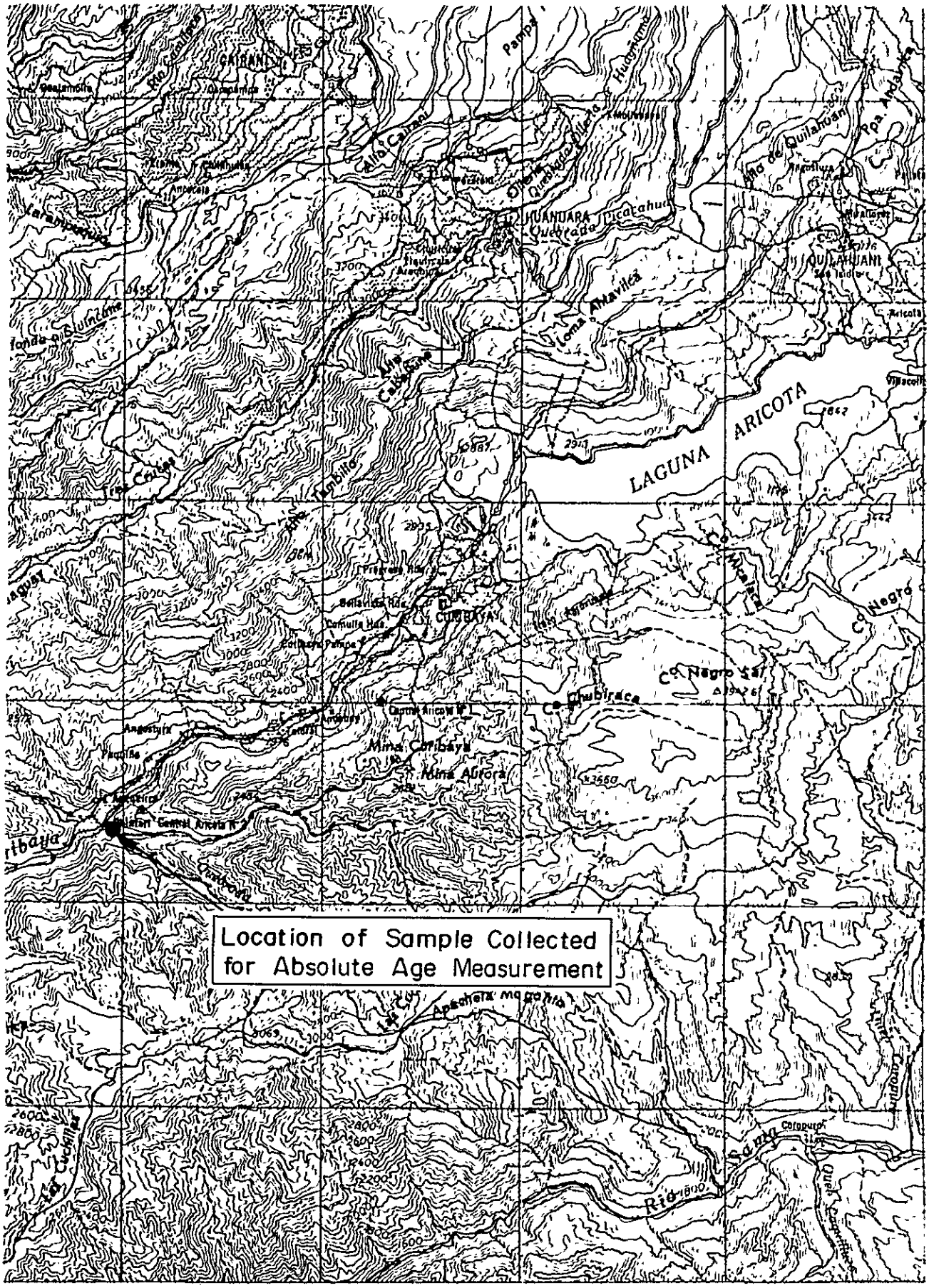
Traces of debris flows which had occurred on several occasions can be seen at Chintari. In order to learn at what kind of frequency these debris flows had occurred, fragments of plants caught at the bottom of the debris flow comprising the present ground surface were collected and the age was measured.

The age was measured by the radiocarbon C^{14} dating method. The measurement obtained was the following:

B.P. *470 $\pm$ 120 yr (1480 A.D.)
(Number of years before 1950)

Principle of C^{14} Method: The C^{14} Method takes advantage of the fact that when a radioactive element is isolated from a system which had been in equilibrium the quantity of the base element decreases with time. The concentration of C^{14} on the earth has been in a steady state for at least the past several tens of thousand years. This C^{14} becomes CO_2, is mixed with ordinary $C^{12}O_2$ to be diffused in the atmosphere and in water. In anything living today there exists C^{14} of the same concentration as in the atmosphere from metabolism. When a living organism dies, becomes buried, and there is no more supplementation of C^{14} from outside, C^{14} decays and decreases. Accordingly, if the quantity of C^{14} in the remains of an organism is measured by the number of beta particles emitted from the C^{14}, the number of years since the organism died and became buried can be calculated.

*B.P.: abbreviation of "Before Physics"


LAGUNA ARICOTA
Location of Sample Collected
for Absolute Age Measurement

A.VI.2.4 Microfossil Analysis

In order to obtain data for studying the watertightness of the projected reservoir area of Pasto Grande Dam, topsoil of Pampa Pasto Grande was collected and microfossils were analyzed. This was done with the purpose of finding whether Pampa Pasto Grande had held water in the past as a lake.

The microfossils contained in the sand were analyzed, especially, pollens of aquatic plants and fossils of diatoms which had lived in water. As a result, a large quantity of diatom fossils were detected. These diatoms were all of fresh water species, and it is estimated that the environment they had lived in was that of waters such as a lake where there was little flow of water.

(1) Pollen Analyses

The method of analysis was according to the following procedure:

Sample → Separation of fines (silt, clays) → Treatment with hydrogen fluoride → Heavy liquid separation → Washing with water → Observation, appraisal

As a result of appraisal, the following pollen and spore fossils were detected:

Trees	:	Podocarpus
		Malvaceae
Grasses	:	Chenopodiaceae
		Convolvulaceae
		Geranium
		Campanulaceae
		Gramineae

These are all land plants, and pollens of aquatic grasses were not found. However, there were what could be seen to be moss spores which were the only things estimated to be related to watery areas.

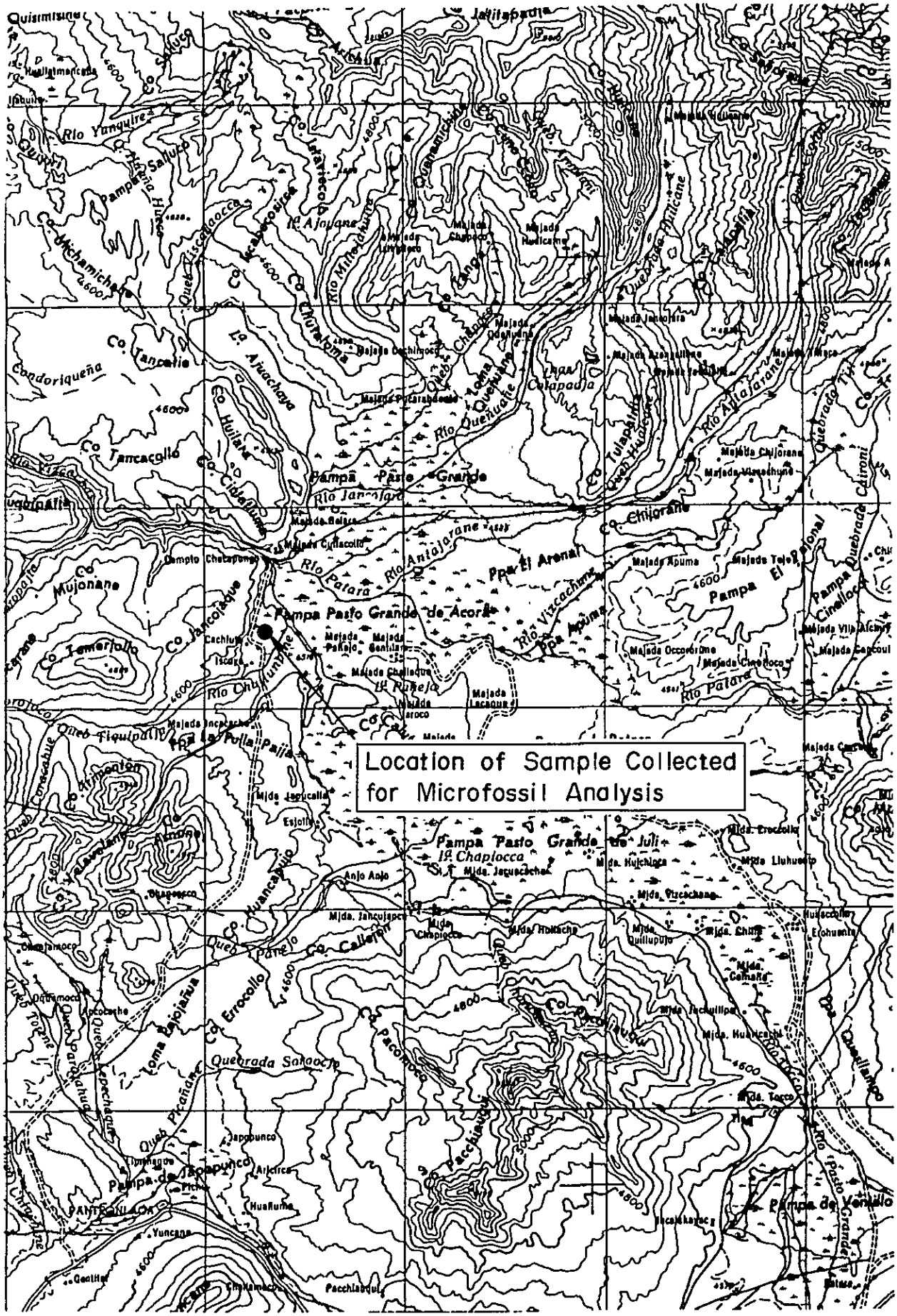
(2) Diatom Analyses

Analyses were performed by the following procedure:

Sample → H_2O_2 heating treatment → Separation of residue with dispersing agent → Removal of fine sand by L-tube → Washing with water → Sealing by rigolac → Observation, appraisal

The results of the analyses are described below.

The largest in quantity were Navicula mutica (indifferent forms), which live in a wide range of water quality, with little migration. Pinnularia borealis (limnophilous forms) favor an environment where there is little flow of water. Others detected were Hantzschia amphioxys (inhabitant without regard to water flow), Cocconeis placentula (lotic and attached) and Synedra parasitica.


Location of Sample Collected
for Microfossil Analysis

APPENDIX—VII

AGRICULTURAL BENEFIT FROM IRRIGATION

CONTENTS

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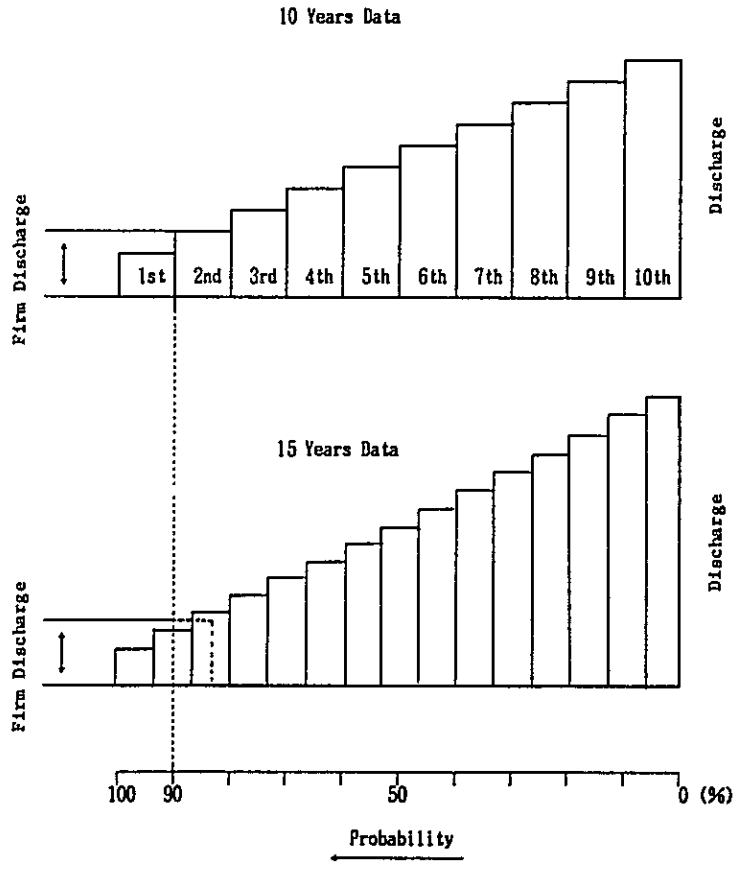
APPENDIX VII AGRICULTURAL BENEFIT FROM IRRIGATION

A.VII.1 Available Irrigation Water

The source of water for the irrigated areas of Locumba and Ite Norte is the lake water of Laguna Aricota, with the water discharged after power generation being used. The agricultural benefit due to irrigation is the difference between the cases with and without the Project of water supply for Laguna Aricota. For the calculation of agricultural benefit from irrigation, firm discharge for 90% of the time was adopted. This is the minimum discharge of 2.5 years corresponding to 90% firm discharge as a result of reservoir operation of the Laguna Aricota in accordance with the power demand based on hydrological data for the 15-year period from 1966 to 1980 (see 8.3, Chapter 8), and is as shown in Fig. A.VII-1, Firm Discharge Explanation Diagram.

Fig. A.VII-1 Firm Discharge Explanation Diagram



Further, since electric power demand varies according to year, the effectiveness ratio of power generation discharge as irrigation water is the lower limit of monthly energy production of the Aricota System, and the lower limit for the 5-year period from 1978 through 1982 is as shown in Table A.VII-1 (see Fig. 8-17).

Table A.VII-1 Effectiveness Ratio by Month

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.
Effectiveness Ratio	0.99	0.92	0.86	0.86	0.90	0.97

Month	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Effectiveness Ratio	0.95	0.91	0.80	0.90	0.97	1.03

As a result of the above, the irrigation water available for the Locumba and Ite Norte irrigation areas are as shown in Table A.VII-2(1) and (2).

Table A.VII-2(1) Available Irrigation Water Without Project

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
90% Dependable Discharge (m^3/sec)	1.4	1.8	1.8	1.8	1.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Effectiveness Ratio	0.99	0.92	0.86	0.86	0.90	0.97	0.95	0.91	0.80	0.90	0.97	1.03
Available Irrigation Water (m^3/sec)	1.39	1.66	1.55	1.55	1.26	0.97	0.95	0.91	0.80	0.90	0.97	1.03

Table A.VII-2(2) Available Irrigation Water with Project

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
90% Dependable Discharge (m^3/sec)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Effectiveness Ratio	0.99	0.92	0.86	0.86	0.90	0.97	0.95	0.91	0.80	0.90	0.97	1.03
Available Irrigation Water (m^3/sec)	2.97	2.76	2.58	2.58	2.70	2.91	2.85	2.73	2.40	2.70	2.91	3.09

A.VII.2 Irrigable Area and Agricultural Benefit

In order to estimate the agricultural benefit from the Project, the irrigable area downstream of the Aricota Power Station Group was obtained by the procedure below based on the available irrigation water obtained in the preceding section.

(1) The monthly average discharge were used as the bases.

(2) A quantity of 0.5 m^3/sec throughout the year was deducted from the available irrigation water at the power station outlet as city water supply for Ilo.

(3) The remaining available irrigation water of (2) above is distributed in proportion to the 3,020 ha of the Locumba district and the 1,300 ha of the Ite Norte district, but assuming that there would be 25% recharge water from the Locumba district to the Ite Norte district, the allocation is to be 0.7 to 0.3.

Therefore, in case of the following:

Irrigation water to Locumba district = A
Irrigation water to Ite Norte district = B
$A + B = 1$
$A : (0.25A + B) = 0.7 : 0.3$

In effect, $A = 0.848$, $B = 0.152$

The irrigable areas at the Locumba and Ite Norte districts without implementation of the Project and with implementation obtained by the above procedure are as shown in Table A.VII-3 and Table A.VII-4, respectively.

The irrigation water quantities per 1,000 ha at the Locumba and Ite Norte districts are as shown in Table A.VII-5.

Table A.VII-3 Monthly Irrigable Areas at Locumba and Ite Norte Districts Without Project

	Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Average
	Power Generation Discharge (m^3/sec), (1)	1.39	1.66	1.55	1.55	1.26	0.97	0.95	0.91	0.80	0.90	0.97	1.03	1.16
	Downstream Available Irrigation Water (m^3/sec), (2) = (1) - 0.5 m^3/sec	0.89	1.16	1.05	1.05	0.76	0.47	0.45	0.41	0.30	0.40	0.47	0.53	0.66
Locumba District	Available Intake Water (m^3/sec), (3) = (2) x 0.848	0.75	0.98	0.89	0.89	0.64	0.40	0.38	0.35	0.25	0.34	0.40	0.45	0.56
	Irrigation Water per 1,000 ha (m^3/sec), (4)	1.06	1.06	0.83	0.76	0.57	0.50	0.48	0.51	0.53	0.50	0.49	0.45	0.65
	Irrigable Area (ha), (5) = (3)/(4) x 1,000	708	925	1,072	1,171	1,123	800	792	686	472	680	816	1,000	854
	Locumba District Recharge Water (m^3/sec), (6) = (3) x 0.25	0.19	0.25	0.22	0.22	0.16	0.10	0.10	0.09	0.06	0.09	0.10	0.11	0.14
Ite Norte District	Available Intake Water (m^3/sec), (7) = (2) x 0.152	0.14	0.18	0.16	0.16	0.12	0.07	0.07	0.06	0.05	0.06	0.07	0.08	0.10
	Available Irrigation Water (m^3/sec), (8) = (6) + (7)	0.33	0.43	0.38	0.38	0.28	0.17	0.17	0.15	0.11	0.15	0.17	0.19	0.24
	Irrigation Water per 1,000 ha (m^3/sec), (9)	0.98	0.94	0.71	0.72	0.62	0.65	0.52	0.55	0.50	0.49	0.54	0.52	0.65
	Irrigable Area (ha), (10) = (8)/(9) x 1,000	337	457	535	528	452	262	327	273	220	306	315	365	365

Table A.VII-4 Monthly Irrigable Areas at Locumba and Ite Norte Districts with Project

	Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Average
	Power Generation Discharge (m^3/sec), (1)	2.97	2.76	2.58	2.58	2.70	2.91	2.85	2.73	2.40	2.70	2.91	3.09	2.77
	Downstream Available Irrigation Water (m^3/sec), (2) = (1) - 0.5 m^3/sec	2.47	2.26	2.08	2.08	2.20	2.41	2.35	2.23	1.90	2.20	2.41	2.59	2.27
Locumba District	Available Intake Water (m^3/sec), (3) = (2) x 0.848	2.09	1.92	1.76	1.76	1.87	2.04	1.99	1.89	1.61	1.87	2.04	2.20	1.92
	Irrigation Water per 1,000 ha (m^3/sec), (4)	1.06	1.06	0.83	0.76	0.57	0.50	0.48	0.51	0.53	0.50	0.49	0.45	0.65
	Irrigable Area (ha), (5) = (3)/(4) x 1,000	1,972	1,811	2,120	2,316	3,280	4,080	4,146	3,706	3,038	3,740	4,163	4,889	3,272
Ite Norte District	Locumba Area Recharge Water (m^3/sec), (6) = (3) x 0.25	0.52	0.48	0.44	0.44	0.47	0.51	0.50	0.47	0.40	0.47	0.51	0.55	0.48
	Available Intake Water (m^3/sec), (7) = (2) x 0.152	0.38	0.34	0.32	0.32	0.33	0.37	0.36	0.34	0.29	0.33	0.37	0.39	0.34
	Available Irrigation Waer (m^3/sec), (8) = (6) + (7)	0.90	0.82	0.76	0.76	0.80	0.88	0.86	0.81	0.69	0.80	0.88	0.94	0.82
	Irrigation Water per 1,000 ha (m^3/sec), (9)	0.98	0.94	0.71	0.72	0.62	0.65	0.52	0.55	0.50	0.49	0.54	0.52	0.65
	Irrigable Area (ha), (10) = (8)/(9) x 1,000	918	872	1,070	1,056	1,290	1,354	1,654	1,473	1,380	1,633	1,630	1,808	1,345

Table A.VII-5 Monthly Quantities of Irrigation Water at Locumba and Ite Norte Districts

	Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Average
Locumba	Irrigation Water for 3,020 ha*	3.20	3.19	2.51	2.29	1.72	1.50	1.45	1.54	1.60	1.52	1.49	1.35	1.94
	Irrigation Water per 1,000 ha	1.06	1.06	0.83	0.76	0.57	0.50	0.48	0.51	0.53	0.50	0.49	0.45	0.65
Ite Norte	Irrigation Water for 1,300 ha*	1.28	1.22	0.92	0.94	0.81	0.84	0.68	0.71	0.65	0.64	0.70	0.68	0.84
	Irrigation Water per 1,000 ha	0.98	0.94	0.71	0.72	0.62	0.65	0.52	0.55	0.50	0.49	0.54	0.52	0.65

* Values given in "Desarrollo Integral de los Recursos Hídrico de Tacna y Moquegua, Volumen II, Esquemas Hidráulicos de Mejoramiento de Riego, Tomo IX Afianzamiento Hídrico de Aricota, Estudio de Pre-factibilidad, Junio 1981," adopted without modification.

As a result of the above, the differences between the annual maximum irrigable areas with and without the Project at the Locumba and Ite Norte districts and the agricultural benefits are as shown in Table A.VII-6.

Table A.VII-6 Annual Agricultural Benefits

ITEM	LOCUMBA	ITE NORTE	TOTAL
Minimum Irrigable Area Without Project(ha), [1]	472	220	692
Minimum Irrigable Area with Project (ha), [2]	1,811	872	2,683
Difference (ha), [3] = [2] - [1]	1,339	652	1,991
Agricultural Benefit per 1 ha (US$/ha)*, [4]	710	626	-
Agricultural Benefit (US$), [5] = [3] x [4]	950,690	408,152	1,358,842

* See Item VII-3

A.VII.3 Agricultural Benefit per Unit Area(ha)

For the cultivated areas and the planting ratios of the Locumba and Ite Norte districts, the values given in the pre-feasibility report concerning water supplementation to Laguna Aricota prepared by Oficinas de Estudios of the Peruvian Minesterio de Algricultura were adopted without alteration, and are as shown in Table A.VII-7.

The production cost by crop, yield, etc. per unit area are what were furnished by CORDETACNA and are as shown in Table A.VII-8. However, corrections as described below were made since there were parts in the data furnished by CORDETACNA where observations were incomplete, or parts thought to be unsuitable.

(1) Unit Price of Alfalfa

On calculation of rates of return based on the data furnished by CORDETACNA, the values were 89.9% for the Locumba district and 90.6% for the Ite Norte district and judged to be abnormally high, so that as a result of comparison studies as in the Table A.VII-9 it was decided to adopt 24 soles/kg, and as a consequence, the rates of return became 48.7% for the Locumba district and 52.1% for the Ite Norte district, which were considered to be reasonable levels (see Table A.VII-10).

There were other crops for which rates of return were thought to be too high, but since the planting ratios are small with influences on benefit studies of the Project insignificant, it was decided to use the CORDETACNA data without alteration.

(2) Forestales

Since forestales are utilized as windbreak tree stands and production of lumber is not the purpose, it was decided not to consider any profit.

(3) Fruits of Locumba District

The average value for cirolera, higuera, manzana, and damasco was taken into account.

(4) Haba y Otros

The trigo, haba grano verde y seco, and caña de azúcar were grouped together as haba y otros.

These crops differ in acreage depending on the year, and therefore, the average value for maiz amilaceo, maiz choclo, aji, cebolla, papa, camote, and ajo was considered as the return per unit area.

(5) Maiz Chala of Ite Norte District

Since this crop is utilized as feed also, the return was judged to be of the same degree as alfalfa, and taking into consideration the period of crop cultivation, four twelfths of alfalfa were calculated.

The results of the above are as shown in Table A.VII-11, and the agricultural benefits per unit area (ha) are US$710/ha for the Locumba district and US$626/ha for the Ite Norte district.

Table A.VII-7 Superficie de Cultivo Según Cultivos en Valle Locumba e Irrigación Ite Norte

Cultivos	Locumba		Ite Norte	
	Area (ha)	%	Area (ha)	%
Total	3,020	100	1,300	100
Total Forrajeros	2,437	80.6	1,028	79.0
Alfalfa	2,437	80.6	1,028	79.0
Total Permanentes	84	2.8	-	-
Frutales	53	1.8	-	-
Vid	22	0.7	-	-
Carrizo	9	0.3	-	-
Total Transitorios	449	14.9	228	17.6
Maíz amiláceo	190	6.3	42	3.2
Maíz choclo	35	1.2	6	0.5
Maíz chala	-	-	144	11.1
Trigo	6	0.2	-	-
Haba granoverdey seco	42	1.4	-	-
Caña de azúcar	19	0.6	-	-
Aji	108	3.6	36	2.8
Cebolla	9	0.3	-	-
Papa	40	1.3	-	-
Total Forestales	50	1.7	44	3.4
Caña brava	23	0.8	-	-
Molle y sauce	24	0.8	3	0.3
Eucaliptus	3	0.1	3	0.2
Casuarinas	-	-	30	2.3
Ciprés	-	-	3	0.2
Tomasiri	-	-	5	0.4

Fuente: Desarrollo Integral de los Recursos Hídricos de Tacna y Moquegua, Volumen II Esquemas Hidráulicos de Mejoramiento de Ríego, Tomo IX Afianzamiento Hidrico de Aricota, Estudio de Pre-Factibilidad, Junio 1981.

Table A-VII-8 Determinacion de los Costos de Produccion por Cultivo, Campaña e Hectarea - 1982 Febrero (CORDETACNA)

	Item / Cultivos	Costos Operativos (Soles)	Costos Administrativos (Soles)	Costo Financiero (Soles)	Costo Total (Soles)	Produccion Bruta (kg/ha)	Mermas (kg/ha)	Autoconsumo : (kg/ha)	Produccion NETA (kg/ha)	Precio (Soles/kg)	Ingresos Totales (Soles)	Beneficio por Hectarea (Soles/ha)	Porcentaje de Beneficio (%)
LOCUMBA	Alfalfa	437,359	26,242	147,000	601,651	57,000	5,700	1,710	49,590	120.0	5,950,800	5,349,199	89.9
	Yid para mesa	146,462	8,788	-	155,250	10,000	400	100	9,500	350.0	3,325,000	3,169,750	95.3
	Cirolera	275,474	16,528	161,000	453,002	6,000	240	60	5,700	400.0	2,280,000	1,826,998	80.1
	Higuera	275,474	16,528	-	292,002	7,250	218	37	6,995	330.0	2,308,350	2,016,348	87.4
	Manzana	580,319	34,819	216,650	831,788	4,000	120	20	3,860	400.0	1,544,000	712,212	46.1
	Damasco	241,831	14,510	161,000	417,341	9,000	450	90	8,460	400.0	3,384,000	2,966,659	87.7
	Maíz amiláceo	503,352	30,213	113,750	647,515	2,000	80	20	1,900	495.0	940,500	292,985	31.2
	Maíz choclo	500,391	30,024	113,750	644,165	6,000	600	120	5,280	270.0	1,425,600	781,435	54.8
	Aji fresco	630,639	37,838	149,800	818,277	8,600	344	86	8,170	350.0	2,859,500	2,041,223	71.4
	Cebolla de cabeza	889,630	53,378	287,000	1,230,008	11,000	330	77	10,593	120.0	1,271,160	41,152	3.2
	Papa	1,358,301	81,498	252,000	1,691,799	10,750	430	108	10,212	370.0	3,778,440	2,086,641	55.2
	Camote	657,569	39,454	131,600	828,623	12,000	480	120	11,400	230.0	2,622,000	1,793,377	68.4
	Ajo	813,660	48,820	287,000	1,149,480	15,000	450	75	14,475	700.0	10,132,500	8,983,020	88.7
ITE NORTE	Alfalfa	437,359	26,242	147,000	601,601	61,000	6,100	1,830	53,070	120.0	6,368,400	5,766,799	90.6
	Maíz amiláceo	503,352	30,213	113,750	647,515	1,880	75	19	1,786	490.0	875,140	227,625	26.0
	Maíz choclo	500,391	30,024	113,750	644,165	6,000	600	120	5,280	265.0	1,399,200	755,035	54.0
	Aji fresco	630,639	37,838	149,800	818,277	8,500	340	85	8,075	370.0	2,987,750	2,169,473	72.6

Table A.VII-9 Unit Price Comparison and Unit Price Adopted

District or Report	CORDETACNA-furnished Data	Modified 2nd Stage Plan Tacna	Desagües 2/ Tratados Tacna	3/ Candarave
Unit Price (s/./kg)	120	0.40	1.70	10
Time of Estimation (yr.mo)	1,983.2	1,971.11	1,977.10	1,981.6
Dollar Exchange Rate (s/.)	990	26.8	102.12	419.13
Unit Price in Dollrs (US$/kg)	0.121	0.015	0.017	0.024

Unit Price Adopted = US$0.024/kg ÷ s/.990
= s/.23.76/kg ≒ s/.24/kg

Reasons for Adoption

(1) The unit prices in data furnished by CORDETACNA are extraordinarily high.

(2) The unit prices are the newest other than those furnished by CORDETACNA, while the unit price of alfalfa is showing a tendency for escalation.

(Note) 1/: Report on Modified Second Stage Development of Plan Tacna, November 1971, EPDC.

2/: Proyecto de Riego con Desagües Tratados Tacna, Estudio Definitivo, Convenio Zona Agraria VII/USAID.

3/: Diagnostico de los Sectores de Riego Gandarave-Totora, Dirección General de Proyectos Especiales, CORDETACNA, TACNA, Febrero de 1983.

Table V.VII-10 Amount of Return and Rate of Return of Alfalfa According to Corrected Unit Price

ITEM		LOCUMBA	ITE NORTE
1.	Production Cost (Soles)		
	Cultivation Cost	437,359	437,359
	Administrative Cost	26,242	26,242
	Interest	147,000	147,000
	Total	610,601	610,601
2.	Production Quantity (kg/ha)		
	Gross Production Quantity	57,000	61,000
	Loss (10%)	5,700	6,100
	Private Consumption, Other (3%)	1,710	1,830
	Net Production Quantity	49,590	53,070
3.	Return		
	Net Production Quantity (kg/ha)	49,590	53,070
	Unit Price (sol/kg)	24.0	24.0
	Gross Return	1,190,160	1,273,680
	Production Cost	610,601	610,601
	Net Return	579,559	663,079
	Rate of Return (%)	48.7	52.1

Table A.VII-11 Returns per Unit Area at Locumba and Ite Norte Districts

District / Corp	LOCUMBA DISTRICT				ITE NORTE DISTRICT			
	Cultivated Area (ha)	Return per Unit Area (Sol/ha)	Return per Unit Area (US$/ha)	Gross Return (US$)	Cultivated Area (ha)	Return per Unit (Sol/ha)	Return per Unit (US$/ha)	Gross Return (US$)
Alfalfa	2,437	579,559	585	1,425,645	1,028	663,079	670	688,760
Frutales	53	1/ 1,880,554	1,900	100,700	0	-	-	-
Vid Para Mesa	22	3,169,750	3,202	70,440	0	-	-	-
Maiz Amilaceo	190	292,985	296	56,240	42	227,625	230	9,660
Maiz Choclo	35	781,435	789	27,615	6	755,035	763	4,578
Maiz Chala	0	-	-	-	144	3/ 224,026	226	32,544
Haba y Otros	67	2/ 2,288,548	2,312	154,904	0	-	-	-
Aji Fresco	108	2,041,223	2,062	222,696	36	2,169,473	2,191	78,876
Cebolla de Cabeza	9	41,152	42	378	0	-	-	-
Papa	40	2,086,641	2,108	84,320	0	-	-	-
Forestales	59	0	0	0	44	0	0	0
Total	3,020			2,142,938	1,300			814,418
Agricultural Benefit per Unit Area		$\frac{2,142,938}{3,020}$ = 710 US$/ha				$\frac{814,418}{1,300}$ = 626 US$/ha		

(Note) 1/: (1,826,998 + 2,016,348 + 712,212 + 2,966,659)/4 = 1,880,554 soles/ha

2/: (292,985 + 781,435 + 2,041,223 + 41,152 + 2,086,641 + 1,793,377 + 8,983,020)/7 = 2,288,548 soles/ha

3/: $672,079 \times \frac{4}{12}$ = 224,026 soles/ha

APPENDIX–VIII

LIST OF DATA COLLECTED

APPENDIX VIII LIST OF DATA COLLECTED

No. 1

No.	Name of Data	Form	Place Obtained or Name of Publishing Organ	Remarks
1	Development of Water Supply from Pasto Grande Reservoir for Southern Peru Copper Corporation, Oct. 1967	Book	SPCC	Collected by JICA Premission
2	Southern Peru Copper Corporation	Book	SPCC	Ditto
3	Report on Modified Second Stage Development of Plan Tacna Vol. I, Nov. 1971	Book	EPDC	Ditto
4	Report on Modified Second Stage Development of Plan Tacna Vol. II, Nov. 1971	Book	EPDC	Ditto
5	Report on Modified Second Stage Development of Plan Tacna Vol. III, Nov. 1971	Book	EPDC	Ditto
6	Exposición de la Corporación Departmental de Desarrollo de Tacna al XXXII Curso de Defensa Nacional del Centro de Altos Estudios Militares, Jun. 1982	Book	CORDETACNA	Ditto
7	Investigación Hidrogeológica de Vilacota y Alrededores	File	CORDETACNA	Copy
8	Afianzamiento Hídrico de Aricota Estudio de Pre-Factibilidad	Book	INAF	Copy
9	Catálogo Peruano de la Construcción	Book	Cámara Peruana de la Construcción	Collected by JICA Premission
10	Tabla de la Alquiler de Maquinarias y Equipos de Construcción	Book	Ditto	Ditto
11	Informe Estadístico, 1979	Book	Instituto Nacional de Planificación	Ditto
12	Informe Estadístico, 1980	Book	Ditto	Ditto
13	Informe Estadístico, 1981	Book	Ditto	Ditto
14	Informe Estadístico, 1982	Book	Ditto	Ditto
15	Memoria Descriptiva, 1980	Book	ORDETAM	Compliments of CORDETACNA
16	Skillings Mining Review	Book	SPCC	Purchased
17	Perú, 1982	Book	Book Store	Purchased
18	Plan Nacional de Desarrollo, 1982 - 1983	Book	CORDETACNA	Collected by JICA Premission
19	Afianzamiento de la Potencia del Sistema Eléctrico Tacna-Moquegua Vol. 1 Informe, Nov. 1979	Book	ELECTROPERU	Copy
20	Afianzamiento de la Potencia del Sistema Eléctrico Tacna-Moquegua Vol. 2 Planos, Nov. 1978	Book	Ditto	Copy

APPENDIX VIII LIST OF DATA COLLECTED

No. 2

No.	Name of Data	Form	Place Obtained or Name of Publishing Organ	Remarks
21	Línea de Transmisión Aricota-Tacna Estudio Definitivo Memoria Descriptiva, Set. 1981	Book	ELECTROPERU	Copy
22	Planeamiento del Sistema Electrico Interconectado Sur-Oeste Period 1981 - 1990, Nov. 1981	Book	Ditto	Copy
23	Proyecto de Riego con Desagues Tratados Tacna, Oct. 1977	Book	Ministerio de Agricultura, Oficina de Proyectos de Inversión	Compliments of CORDETACNA
24	Diagnóstico Subsectores de Riego Candarave-Totora, 1983	Book	CORDETACNA	Ditto
25	Estudio Integral de las Cuencas de Tacna y Moquegua	Book	INAF	Collected by JICA Premission
26	Red Meteorológica del Area del Proyecto	Book	INAF	Ditto
27	Calidad Agrícola del Agua Superficial de las Cuencas Comprometidas	Book	INAF	Ditto
28	Estudio Hidrológico del Río Viscachas en Pasto Grande	Book	ONERN and CORDETACNA	Compliments of CORDETACNA
29	Batimetria Laguna Loriscota, Ene. 1983	File	CORDETACNA	Ditto