

Geochronology and Isotopic Geochemistry

Work Order No.: **27196**

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Customer: **Geotermica Salvadorena S.A.**
Project name:
Number of samples: **12**
Sample type: **Rock**
Analytical works: **K-Ar, Ar-Ar, U-Pb, Rb-Sr, Sm-Nd dating**
Mineral separation:
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CERTIFIED BY:

Dr. Yakov Kapusta
Geochronology and Isotopic Geochemistry
General Manager

Table 1. Plateau and Total Gas ages and other analytical data

Sample ID	Material	Plateau Age (Ma)	MSWD	% ³⁹ Ar	n	Total Gas Age (Ma)	Weight (mg)	J-value (28.02)	Run (L#)
CHG-13	hornblende	1.27±0.06	1.11	91.9	7	1.60±0.13	30.34	0.0007064	55849
SM-51	groundmass	0.58±0.04	1.81	41.1	3	1.3±0.6	55.85	0.0007104	55862
CHG-48	groundmass	0.4±0.7	1.04	57.1	3	3±3	64.8	0.0007085	55863
CHG-33	groundmass	0.15±0.02	0.91	84.6	6	0.8±0.3	59.27	0.0007079	55864
SM-50	groundmass	0.16±0.05	1.77	89.2	6	0.4±0.2	63.15	0.0007092	55865
SM-36	groundmass	1.22±0.06	0.96	57.9	6	2.2±0.6	102.46	0.0007111	55866
CHG-47	groundmass	0.41±0.10	0.71	50.7	4	2.5±1.0	84.14	0.0007117	55867
SM-7	groundmass	0.63±0.06	1.5	71.6	6	2.9±0.6	101.68	0.0007119	55873
CHG-25	plagioclase	8.4±1.2	0.16	65.3	4	14±2	22.97	0.0007062	55848
CHG-42	plagioclase	n/a	n/a	n/a	n/a	86.4±0.3	68.1	0.0007039	55842
CHG-44	plagioclase	0.16±0.06	2.48	99.7	10	0.2±0.5	68.11	0.0007061	55843
CHG-50	plagioclase	1.3±0.4	0.93	100	11	0.5±1.0	59.24	0.0007083	55844
CHG-26	plagioclase	n/a	n/a	n/a	n/a	10±15	42.47	0.0007085	55845
SM-49	plagioclase	0.79±0.07	1.22	94.1	10	0.87±0.14	74.29	0.000712	55868
SM-23	plagioclase	1.63±0.03	1.42	99.5	10	1.61±0.05	104.98	0.0007112	55869
SM-28	plagioclase	0.86±0.03	1.11	100	11	0.86±0.04	97.5	0.0007105	55870
SM-39	plagioclase	0.87±0.03	1.72	100	11	0.87±0.04	101.12	0.0007104	55871
CHG-15	plagioclase	1.48±0.02	0.16	80.4	6	1.45±0.03	103.39	0.0007112	55872

L# = Lab number

n = number of steps for plateau

%³⁹Ar = percentage of total ³⁹Ar comprising the plateau steps

All errors at 1σ

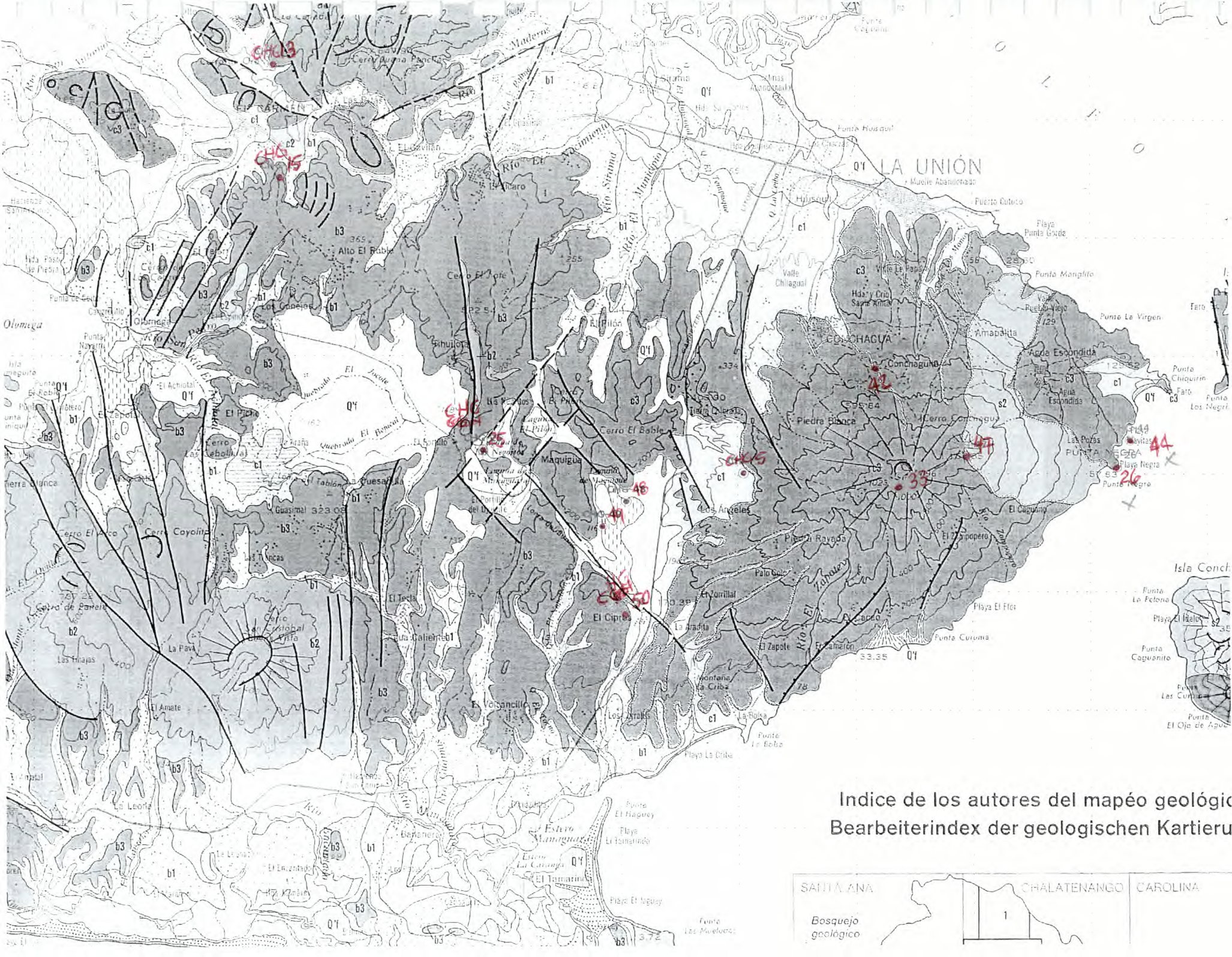
MSWD = mean square weighted deviates for plateau steps

n/a = not applicable

FECHADO RADIOMETRICO DE LAS ROCAS DE APASTEPEQUE Y OBRAJUELO

Muestra	Coordenadas Lambert	Ubicación	K/Ar (Ma)	Ar-Ar (Ma)	Fecha Aceptado
OBRAQ-3	529099/274653	Ladera NE Cerro Malacara	2.0 +/- 0.3		2.0 +/- 0.3
OBRAQ-4	536197/272326	Quebrada Los Platanares	2.8 +/- 0.3		2.8 +/- 0.3
OBRAQ-7	534697/270235	Río Higuayo	2.7 +/- 0.7		2.7 +/- 0.7
OBRAQ-12	533281/272199	Flanco SO del Cerro Chachacasno	1.7 +/- 0.2		1.7 +/- 0.2
OBRAQ-14	533368/274258	Cerro La Laguna	0.5 +/- 0.2		0.5 +/- 0.2
OBRAQ-15	532948/273674	Cerro al Sur del Cerro La Laguna	1.6 +/- 0.2		1.6 +/- 0.2
APAQ-4	529300/287750 (aprox)	Cerro Los Amaya	2.2 +/- 0.5		2.2 +/- 0.5
APAQ-9	523300/284750 (aprox)	Cerro Las Delicias, San Esteban Catarina	0.6 +/- 0.4		0.6 +/- 0.4
APAQ-11	529400/286600 (aprox.)	Entrada a Santa Clara	1.6 +/- 1.2	1.3 +/- 0.6	1.3 +/- 0.6
OBRA-35	279052/532971	Río San Felipe	4.0 +/- 0.8		4.0 +/- 0.8
OBRA-36	280772/532458	Cerro Tecomatepeque	0.4 +/- 0.2		0.4 +/- 0.2
OBRA-39	283316/527707	Flanco Este del Cerro El Cerrón	2.8 +/- 0.2		2.8 +/- 0.2
OBRA-40	283200/523420	Cerro Santa Rita	0.8 +/- 0.3		0.8 +/- 0.3





Indice de los autores del mapéo geológico
Bearbeiterindex der geologischen Kartierung

SANTA ANA

Bosquejo
geológico

CHALATENANGO

CAROLINA

1

Results

The K concentration was performed by ICP.

The argon analysis was performed using the isotope dilution procedure on noble gas mass spectrometry.

Sample	%K	$^{40}\text{Ar}_{\text{rad}}$, nl/g	% $^{40}\text{Ar}_{\text{air}}$	Age, Ma	Uncertainty, Ma
OBRAQ-3	0.91	0.07	94.0	2.0	0.3
OBRAQ-4	0.83	0.09	93.1	2.8	0.3
OBRAQ-7	0.63	0.06	96.3	2.7	0.7
OBRAQ-12	2.54	0.17	88.4	1.7	0.2
OBRAQ-14	2.53	0.05	98.7	0.5	0.2
OBRAQ-15	1.07	0.07	93.1	1.6	0.2
APAQ-4	0.60	0.05	96.9	2.2	0.5
APAQ-9	1.84	0.04	98.7	0.6	0.4
OBRA-35	0.38	0.06	94.4	4.0	0.8
OBRA-36	2.24	0.03	98.1	0.4	0.2
OBRA-39	1.18	0.12	88.8	2.8	0.2
OBRA-40	2.05	0.06	98.7	0.8	0.3

THIS FILE IS BERLIN1W.SPR						
Updated 25 August 1994						
BE are samples collected by CPW. S are samples collected by IAN						
SAMPLE	MAP	REFERENCE	XRF	TS	DATE	LITHOLOGY AND LOCALITY
BE01	2456I	502652				Blanca Rosa: obsidian lithics in fall
BE02	2456I	502652	XRF	TS		Blanca Rosa: dacite pumice block in fall
BE03	2456I	502652				Blanca Rosa: pumice lapilli in fall
BE04	2456I	503680				Hm-coated lithics blocks in an andesitic ignimbrite
BE05	2456I	466738	XRF	TS		Black Ignimbrite: andesite scoria block
BE06	2456I	466738	XRF	TS		Black Ignimbrite: andesite pumice lapilli
BE07	2456I	466738	XRF	TS		Grey Ignimbrite: andesite scoria block
BE08	2456I	466738	XRF	TS		Grey Ignimbrite: andesite pumice lapilli
BE09	2456I	465729				Black Ignimbrite: xenoliths in scoria block
BE10	2456II	525547	XRF	TS	KA	Hb andesite lava: Loma Pacha
BE11	2456II	478556	XRF	TS		Basalt lava: Taburete
BE13	2556III	579613				Basalt lava: Oromontique
BE14	2556III	579616	XRF	TS	KA	Basalt lava: Oromontique
BE15	2556III	615585	XRF	TS	KA	Basalt lava: El Tigre
BE16	2556III	615585				Scoria: El Tigre
BE17	2556III	579559				Basalt lava: Usulután
BE18	2556III	577561	XRF	TS		Basalt lava: Usulután
BE19	2556III	582560	XRF	TS	KA	Basalt lava: Usulután
BE20	2556III	585562	XRF	TS		Basalt lava: Usulután
BE21	2556III	605575				Lava: Cerro La Manita
BE22	2556III	561638	XRF	TS		Andesite lava: Cerro Alegria o La Sabana
BE23	2556III	547635	XRF	TS	KA	Basaltic andesite lava: Laguna de Alegria
BE24	2556III	547635	XRF	TS		Basaltic andesite lava: Laguna de Alegria
BE25	2456II	522644	XRF	TS		Basaltic andesite lava: from El Hoyon?
BE26	2556IV	562654	XRF	TS		Andesite lava: Cerro Alegria o La Sabana
BE27	2556IV	542655	XRF	TS		Andesite lava: Tecapa
BE28	2556III	737632				Welded airfall: El Pacayal
BE29	2556III	748637	XRF	TS		Dacite lava: El Pacayal
BE30	2556III	725644	XRF	TS		Andesite lava block in tuff: El Pacayal?
BE31	2556III	704631	XRF	TS		Pacayal 3: dacite pumice from lowest 10cm
BE32	2556III	704631				Pacayal 3: pink pumice
BE33	2556III	704631				Pacayal 3: lithics from lowest pink pumice
BE34	2556III	704631	XRF	TS		Pacayal 3: grey andesite pumice

BE35	2556III	704631	XRF	TS		Pacayal 3: black andesite bomb from lower pumice layer
BE36	2556III	704631				Pacayal 3: lithics from grey pumice layer
BE37	2556III	704631	XRF	TS		Pacayal 3: upper black andesite pumice
BE38	2556III	704631	XRF	TS		Pacayal 3: black andesite bomb from black pumice layer
BE39	2556III	704631				Pacayal 3; grey/black pumice at very top
BE40	2556III	704631				Pacayal 3: lithics from black pumice layer
BE41	2556III	704631				Pacayal 4: pumice lapilli
BE42	2456I	524647	XRF	TS		Pacayal 3: dacite pumice from low in unit
BE43	2456I	524647	XRF	TS		Pacayal 3: andesite pumice from high in unit
BE44	2456I	524647	XRF	TS		Volcan 1: andesite pumice
BE45	2456II	524635	XRF	TS		Basaltic andesite lava: El Hoyon
BE46	2456II	534640	XRF	TS		Basaltic andesite scoria: W parasitic cone of Tecapa
BE47	2456II	527629				Lava block in surge beds: El Hoyon
BE48A	2556IV	749680	XRF	TS	AR	Pacayal 1 ignimbrite: dacite pumice
BE48B	2556IV	749680				Pacayal 1 ignimbrite: grey pumice block
BE49	2556IV	749680				Pacayal 1 ignimbrite: bulk sample
BE50	2556IV	747679	XRF	TS		Pacayal 3 ignimbrite: black sub-pumiceous andesite clasts
BE51	2556IV	747679				Pacayal 3 ignimbrite: bulk matrix
BE52	2556IV	747679		TS		Pacayal 3 ignimbrite: subvitreous comagmatic block
BE53	2556IV	747679		TS		Pacayal 3 ignimbrite: 1.5m comagmatic block
BE54	2556IV	747679				Pacayal 3 ignimbrite: lithics
BE55	2556IV	755683	XRF	TS		Pacayal 1 ignimbrite: large dacite pumice block
BE56	2556IV	760688				Pacayal 1 ignimbrite: pumice block
BE57	2556IV	762694	XRF	TS		Pacayal 1 ignimbrite: dacite pumice block
BE58	2556IV	797719	XRF	TS		Pacayal 1: rhyodacite pumice lapilli fall
BE59	2556IV	807665				Volcan 1: scoria bomb with xenoliths
BE60	2556IV	752687				Black pumice "superblock" in a scoria layer
BE61	2556IV	752688	XRF	TS	KA	Rhyolite lava
BE62	2556IV	732702				Andesite lava floats (3 samples)
BE63	2556IV	683710				Andesite lava: plagioclase-rich
BE64	2556IV	694721				Andesite lava: aphyric banded
BE65	2556IV	717705	XRF	TS		Andesite lava: aphyric banded
BE66	2556IV	789727				Pacayal 1 ignimbrite: basal pumice-rich zone
BE67	2556IV	789727				Pacayal 1 ignimbrite: sand parting below BE66
BE68	2556IV	789727				Pacayal 1 ignimbrite: pumice-depleted zone
BE69	2556IV	789727				Pacayal 1 ignimbrite: pumice lapilli below BE68

BE70	2556IV	752707				Andesite lava: suboutcrop floats
BE71	2556IV	775732	XRF	TS		Pacayal 1 ignimbrite: andesite pumice block
BE72	2556IV	787730				Pumice-lithic ignimbrite: bulk sample
BE73	2556IV	787730				Pumice-lithic ignimbrite: black pumice block
BE74	2556IV	694655				Andesite lava: weakly altered
BE75	2556IV	694655				Calcite vein in altered andesite
BE76	2556IV	694655				Very altered andesite
BE77	2556IV	694655				Efflorescent salts
BE78	2556IV	691647				Altered and veined andesite
BE79A	2556IV	736661	XRF	TS		Pacayal 1 ignimbrite: grey-pink dacite pumice
BE79B	2556IV	736661				Pacayal 1 ignimbrite: mixed grey-black pumice block
BE80	2556III	735581				Vesicular mudstone at thermal area
BE81	2456II	532543				Hb andesite lava: Loma Pacha
BE82	2456II	524559				Hb andesite lava: Loma Pacha
BE83	2556III	542579				Andesite lava: source uncertain
BE84	2556III	546577				Andesite lava block on an explosion crater rim
S016	2556IV	712661				Dacite lava: Chinameca
S039A	2556IV	597708				Dacitic pumice beneath Grey Ignimbrite
S054	2456I	473656				Lava: Berlin old edifice
S060	2456I	511664	XRF	TS	KA	Basalt lava: Berlin W caldera wall
S063	2456I	503683				Grey Ignimbrite: black scoria bomb
S071	2456I	464766				Andesitic Ignimbrite: bulk sample
S079	2456II	427547				Grey Ignimbrite: black scoria bomb
S081	2456I	524649				Volcan 1: pumice
S093	2456II	505613			C14	Charcoal in andesitic scoria flow
S095A	2456II	521639				El Hoyon surge deposits
S095B	2456II	521639				El Hoyon surge deposits
S095C	2456II	521639				El Hoyon surge deposits
S096A	2456II	486632	XRF	TS		Basalt lava: old edifice
S096B	2456II	486632				Lava: Berlin old edifice
S097	2456II	459629		TS		Grey Ignimbrite: comagmatic bombs
S100	2456II	515622				Lava: Las Palmas
S101A	2456II	518621				Pumice fall: dacitic
S101B	2456II	518621				Lithics from pumice fall S101A
S102A	2456II	519623				Scoria bomb: Laguna Ciega/El Hoyon
S102B	2456II	519623	XRF			Pumice fall: Laguna Ciega/El Hoyon
S108A	2556IV	553685				Pumice fall

S108B	2556IV	553685	XRF	TS		Andesite pumice: Grey Chip
S115	2456I	505717				Grey Ignimbrite: bulk sample
S116	2456I	513743				Aphyric lava: Cerro El Portillo
S125	2556IV	544666	XRF	TS		Basaltic andesite lava: Tecapa
S128	2556IV	549665				Lava: Berlin caldera wall
S132A	2456I	466738				Grey Ignimbrite: bulk sample
S132B	2456I	466738				Grey Ignimbrite: lapilli
S132C	2456I	466738				Grey Ignimbrite: lithics
S132D	2456I	466738				Grey Ignimbrite: breadcrust bombs
S132E	2456I	466738	XRF	TS		Grey Ignimbrite: basal fall andesite lapilli
S132F	2456I	466738			AR	Dacite lapilli fall: bulk sample
S132G	2456I	466738	XRF	TS		Dacite lapilli fall: lapilli
S132H	2456I	466738				Black Ignimbrite: bulk sample
S132I	2456I	466738				Black Ignimbrite: lithics
S132J	2456I	466738				Black Ignimbrite: lapilli
S132K	2456I	466738		TS	KA	Black Ignimbrite: comagmatic bomb
S133A	2456I	466729		TS	AR	Pumice lapilli airfall
S133B	2456I	466729	XRF	TS	AR	Dacite pumice lapilli airfall
S133C	2456I	466729				Grey Ignimbrite: scoria fall at base
S133D	2456I	466729				Grey Ignimbrite: matrix
S133E	2456I	466729				Grey Ignimbrite: bomb
S136	2556IV	553719				Grey Ignimbrite: coarse-grained lithic
S146	2556IV	554723			C14	Grey Ignimbrite: charcoal sample
S147A	2556IV	615706	XRF	TS		Dacite lapilli: "Arturo" unit
S147B	2556IV	615706				Well-bedded scoria above S147A
S154	2456II	505615				Scoria: Las Palmas?
S157	2456II	508582	XRF	TS	KA	Basalt lava: Taburete
S160A	2456II	452570				Black Ignimbrite: comagmatic bomb
S162A	2556IV	723695				Pumice fall: uncorrelated
S162B	2556IV	723695	XRF	TS		Pacaya 1 ignimbrite: dacite pumice fall
S171	2556IV	713668	XRF	TS	KA	Dacite lava: Chinameca
S174	2556IV	543675		TS	KA	Lava: Berlin caldera E rim
S175	2556IV	546683				Lava: Berlin caldera E rim
S178	2556IV	551720				Grey Ignimbrite: xenolith in bomb in ignimbrite
S179A	2456II	504615	XRF	TS		Basalt scoria fall: Cerro Las Palmas
S179B	2456II	504615	XRF	TS		Andesite pumice fall lapilli: Cerro Las Palmas
S179C	2456II	504615				Andesite pumice fall bulk: Cerro Las Palmas
S180	2456I	502652	XRF	TS	AR	Blanca Rosa: dacite pumice lapilli

S194	2556IV	642707				Lava clast in debris avalanche
S201	2556III	662641				Pumice: Twins?
S223A	2556IV	645670				Speckled pumice lapilli fall
S223P	2556IV	645670				Speckled pumice lapilli fall
S223Q	2556IV	645670				Pumice lapilli fall
S223R	2556IV	645670				White pumice lapilli fall
S223S	2556IV	645670	XRF	TS		Dark grey andesite lapilli: Grey Chip
S223TL	2556IV	645670	XRF	TS		Twins Lower: speckled dacite pumice fall
S223TU	2556IV	645670	XRF	TS		Twins Upper: speckled dacite pumice fall
S223X	2556IV	645670				Thick white pumice fall
S223Y	2556IV	645670				White pumice fall
S223Z	2556IV	645670				Pumice lapilli with grey ash band
S226	2556IV	697656				Pumice lapilli: Twins? Pacayal 1?
S229	2556III	689641				Lava: Cerro El Volcancillo
S230	2556IV	693648				Altered lava
S232	2556III	704636				Pumice blocks
S233A	2556III	703631				Pacayal 3: andesitic bomb
S233B	2556III	703631				Volcan 1: bulk fall deposit
S233C	2556III	703631				Pacayal 3: pumice, 1m above base
S233D	2556III	703631	XRF			Alegria 3: pumice lapilli
S236	2556III	706613				Lava: Cerro El Limbo (float)
S257A	2556IV	799653	XRF	TS		Pacayal 1: rhyodacite pumice fall
S259A	2556III	796642				Dacitic pumice: BR?
S262	2556III	776626	XRF	TS	KA	Basaltic andesite lava: Cerro El Cimarron
S281A	2556IV	669689				Dacitic pumice fall
S287	2556III	623632	XRF	TS		Basaltic andesite lava: El Tigre N flank
S293	2556IV	687700	XRF	TS	AR	Basalt lava: Lolotique
S300A	2556IV	688708				Dacitic pumice fall beneath BR
S321	2456I	387673				Lava: Cerro Pelon
S322	2456I	393667				Lava: Cerro Verde
S323	2456II	488627				Pumice fall: Cerro Las Palmas?
S343	2556IV	769658				Hydrothermal explosion breccia?

LIST OF XRF ANALYSED SAMPLES

SAMPLE	MAP	REFERENCE	LITHOLOGY AND LOCALITY
BERLIN OLD EDIFICE LAVAS			
S060	2456I	511664	Basalt lava: W caldera wall
S096A	2456II	486632	Basalt lava: W caldera wall
PERIPHERAL CONE LAVAS			
BE10	2456II	525547	Hb andesite lava: Loma Pacha
BE11	2456II	478556	Basalt lava: Taburete
BE14	2556III	579616	Basalt lava: Oromontique
BE15	2556III	615585	Basalt lava: El Tigre
BE18	2556III	577561	Basalt lava: Usulután
BE19	2556III	582560	Basalt lava: Usulután
BE20	2556III	585562	Basalt lava: Usulután
S157	2456II	508582	Basalt lava: Taburete
S287	2556III	623632	Basaltic andesite lava: El Tigre N flank
BERLIN INTRA-CALDERA LAVAS AND SCORIAS			
BE22	2556III	561638	Andesite lava: Cerro Alegria o La Sabana
BE23	2556III	547635	Basaltic andesite lava: Laguna de Alegria
BE24	2556III	547635	Basaltic andesite lava: Laguna de Alegria
BE25	2456II	522644	Basaltic andesite lava: from El Hoyon?
BE26	2556IV	562654	Andesite lava: Cerro Alegria o La Sabana
BE27	2556IV	542655	Andesite lava: Tecapa
BE45	2456II	524635	Basaltic andesite lava: El Hoyon
BE46	2456II	534640	Basaltic andesite scoria: W parasitic cone of Tecapa
S125	2556IV	544666	Basaltic andesite lava: Tecapa
S179A	2456II	504615	Basalt scoria fall: Cerro Las Palmas
S179B	2456II	504615	Andesite pumice fall: Cerro Las Palmas
MISCELLANEOUS LAVAS			
BE29	2556III	748637	Dacite lava: El Pacayal
BE30	2556III	725644	Andesite lava block in tuff: El Pacayal
BE61	2556IV	752688	Rhyolite lava: E of Moncagua
BE65	2556IV	717705	Andesite lava: Lolotique
S171	2556IV	713668	Dacite lava: Chinameca
S262	2556III	776626	Basaltic andesite lava: Cerro Partida o El Cimarron
S293	2556IV	687700	Basalt lava: Lolotique

BERLIN ANDESITIC IGNIMBRITES			
BE05	2456I	466738	Andesite scoria block: lower black ignimbrite
BE06	2456I	466738	Andesite pumice lapilli: lower black ignimbrite
BE07	2456I	466738	Andesite scoria block: upper grey ignimbrite
BE08	2456I	466738	Andesite pumice lapilli: upper grey ignimbrite
S132E	2456I	466738	Andesite lapilli: fall at base of grey ignimbrite
S132G	2456I	466738	Dacite pumice lapilli: airfall
S133B	2456I	466729	Dacite pumice lapilli: airfall
BLANCA ROSA PYROCLASTICS			
BE02	2456I	502652	Dacite pumice block in fall deposit
S180	2456I	502652	Dacite pumice lapilli in fall deposit
PACAYAL 3 AND VOLCAN 1 PYROCLASTICS			
BE31	2556III	704631	Dacite pumice (white): lowest 10cm of Pacayal 3 (Chinameca)
BE34	2556III	704631	Andesite pumice lapilli (grey): lower layers of Pacayal 3 (Chinameca)
BE35	2556III	704631	Andesite bomb (black): lower layers of Pacayal 3 (Chinameca)
BE37	2556III	704631	Andesite scoria lapilli (black): upper layers of Pacayal 3 (Chinameca)
BE38	2556III	704631	Andesite bomb (black): upper layers of Pacayal 3 (Chinameca)
BE42	2456I	524647	Dacite pumice: lower 10cm of Pacayal 3 (Berlin)
BE43	2456I	524647	Andesite pumice: upper 10cm of Pacayal 3 (Berlin)
BE44	2456I	524647	Andesite pumice: Volcan 1 (Berlin)
BE50	2556IV	747679	Andesite scoria clasts: Pacayal 3 ignimbrite (Chinameca)
PACAYAL 1 PYROCLASTICS			
BE48A	2556IV	749680	Dacite pumice lapilli: ignimbrite "B"
BE55	2556IV	755683	Dacite pumice block: ignimbrite "B"
BE57	2556IV	762694	Dacite pumice block: ignimbrite "B"
BE58	2556IV	797719	Rhyodacite pumice lapilli: fall beneath ignimbrite "B"
BE71	2556IV	775732	Andesite pumice block: xenoclast? in ignimbrite "B"
BE79A	2556IV	736661	Dacite pumice block: ignimbrite "B"
S162B	2556IV	723695	Dacite pumice lapilli: fall beneath ignimbrite "B"
S257A	2556IV	799653	Rhyodacite pumice lapilli: fall beneath ignimbrite "B"

MISCELLANEOUS PYROCLASTICS

S108B	2556IV	553685	Andesite pumice: "Grey Chip"
S223S	2556IV	645670	Andesite pumice: "Grey Chip"
S147A	2556IV	615706	Dacite lapilli: "Arturo" unit
S223TU	2556IV	645670	Dacite pumice lapilli: Lower "Twins"
S223TL	2556IV	645670	Dacite pumice lapilli: Upper "Twins"

TABLE 1: RADIOMETRIC AGES FOR BERLIN-CHINAMECA ROCKS

(25/8/94)

SAMPLE & IDENTIFIER	C14 (Yrs B.P.)	K/Ar (Ma)	Ar-Ar (Ma)	COMMENTS
El Hoyon surges (S95)	710±50	-	-	
Pacayal 1 ignimbrite (BE48a)	-	-	0000	
Scoria overlying Twins p. fall (S93)	48300±2700	-	-	
Loma Pacha lava (BE10)	-	0.05±0.06	-	
Oromontique cone lava (BE14)	-	0.10±0.09		
Tecapa cone lava (BE23)	-	0.10±0.02	-	
Blanca Rosa pyroclastics (S180)	-	-	0000	
El Tigre cone lava (BE15)	-	0.147±0.05	-	-
Grey ignimbrite at Mercedes	36490±1700*	-	-	*ELC date
Grey ignimbrite at Mercedes (S146)	35690±520	-	-	
Dacite fall bed beneath Grey ignimbrite (S133A)	-	-	0000	
Dacite fall bed beneath Grey ignimbrite (S133B)	-	-	0000	
Dacite fall bed beneath Grey ignimbrite (S132F)	-	-	0000	
Usulatan cone lava (BE19)	-	0.216±0.04	-	
Moncagua rhyolite lava (BE61)	-	0.89±0.40	-	
Berlin old edifice east lava (S174)	-	0.88±0.10	-	
Berlin old edifice west lava (S60)	-	1.3±0.7		
Berlin old edifice west lava	-	1.4±0.3*	-	*ELC dates
Lolotique lava (S293)	-	-	0000	

FECHADO RADIOMETRICO DE LAS ROCAS DE APASTEPEQUE Y OBRAJUELO					
Muestra	Coordenadas Lambert	Ubicación	K/Ar (Ma)	Ar-Ar (Ma)	Fecha Aceptado
OBRAQ-3	529099/274653	Ladera NE Cerro Malacara	2.0 +- 0.3		2.0 +- 0.3
OBRAQ-4	536197/272326	Quebrada Los Platanares	2.8 +- 0.3		2.8 +- 0.3
OBRAQ-7	534697/270235	Río Higuayo	2.7 +- 0.7		2.7 +- 0.7
OBRAQ-12	533281/272199	Flanco SO del Cerro Chachacasno	1.7 +- 0.2		1.7 +- 0.2
OBRAQ-14	533368/274258	Cerro La Laguna	0.5 +- 0.2		0.5 +- 0.2
OBRAQ-15	532948/273674	Cerro al Sur del Cerro La Laguna	1.6 +- 0.2		1.6 +- 0.2
APAQ-4	529300/287750 (aprox)	Cerro Los Amaya	2.2 +- 0.5		2.2 +- 0.5
APAQ-9	523300/284750 (aprox)	Cerro Las Delicias, San Esteban Catarina	0.6 +- 0.4		0.6 +- 0.4
APAQ-11	529400/286600 (aprox.)	Entrada a Santa Clara	1.6 +- 1.2	1.3 +- 0.6	1.3 +- 0.6
OBRA-35	279052/532971	Río San Felipe	4.0 +- 0.8		4.0 +- 0.8
OBRA-36	280772/532458	Cerro Tecomatepeque	0.4 +- 0.2		0.4 +- 0.2
OBRA-39	283316/527707	Flanco Este del Cerro El Cerrón	2.8 +- 0.2		2.8 +- 0.2
OBRA-40	283200/523420	Cerro Santa Rita	0.8 +- 0.3		0.8 +- 0.3

MUESTRAS PARA DATACION, ZONA ORIENTE II (CONCHAGUA)

No.	Lambert E	Lambert N	Lugar
CHG-33	625163	239628	Plan El Ocotal
CHG-47	626880	240425	Volcan Conchagua
CHG-42	624504	242695	Conchagua-Conchaguita
CHG-44	631033	240848	Las Cuevitas (Playitas)
CHG-48	618163	239283	Cerro El Bable
CHG-49	617544	238651	Loma El Obraje
CHG-50	618141	236435	Montaña El Havillal
CHG-25	614503	240593	Cerro W Laguna Los Negritos
CHG-26	630699	240166	Playa Playitas
CHG-13	609164	250405	Crío. La Cañada
CHG-15	609327	247517	El Carmen
CHG-5	621158	240009	Tierra Blanca

MUESTRAS PARA DATACION, ZONA ORIENTE I (CHILANGUERA)

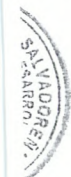
No.	Lambert E	Lambert N	Lugar
SM-28	592705	246073	El Delirio
SM-39	594460	249661	
SM-23	591709	250175	Hda. San Juan Bosco, Cton. La Puerta
SM-49	590024	241093	Valle Nuevo, Chilanguera
SM-7	579963	236667	Carretera hacia Jucuaran
SM-51	582604	237228	La Cruz, Jucuaran
SM-36	596626	252266	

SM-70

TABLA 3.1: FECHADO RADIOMETRICO DE LAS ROCAS DE BERLIN-CHINAMECA

MUESTRA Y IDENTIFICACION	C14 (año B.P.)	K/Ar (Ma)	Ar-Ar (ka)	FECHADO ACEPTADO (ver texto)
Núees Radiales El Hoyón (S95)	710±50	-	-	700 yr B.P.
Escoria sobreyacente pomez Las Gemelos (S93)	48300±2700	-	-	50 ka
Lava Loma Pacha (BE10)	-	0.05±0.06	-	? 50 ka
Lava de los conos de Tecapa (BE23)	-	0.10±0.02	-	(?< 75 ka)
Piroclasticos Blanca Rosa (S180)	-	-	75 ±10	75 ka
Ignimbrita gris a Mercedes	36490±1700*	-	-	no aceptado
Ignimbrita gris a Mercedes (S146)	35690±520	-	-	no aceptado
Pómez dacítica subyacente ignimbrita gris (S133B)	-	-	81±14	100 ka
Pómez dacítica subyacente ignimbrita gris (S132F)	-	-	98±10	100 ka
Lava del cono de Oromontique (BE14)	-	0.10±0.09	-	?0.1 Ma
Lava del cono de El Tigre (BE15)	-	0.147±0.05	-	0.15 Ma
Lava del cono de Usulután (BE19)	-	0.216±0.04	-	0.22 Ma
Lava riolitica de Moncagua (BE61)	-	0.89±0.40	-	? 0.9 Ma
Lava del edificio viejo oriental de Berlín (S174)	-	0.88±0.10	-	0.9 Ma
Lava del edificio viejo occidental de Berlín (S60)	-	1.3±0.7	-	?1.4 Ma
Lava del edificio viejo occidental de Berlín	-	1.4±0.3*	-	1.4 Ma

Fecha de ELC



LLAVE DE LA LEYENDA DEL MAPA

fa

depositos de aluvio y lahar

ff

depositos abanicos de coluvio y lahar

<i>sm</i>	Lavas y escorias de San Miguel (andesitas)		
<i>by</i>	Lavas y escorias de conos juvenes de Berlín (andesitas, andesitas basalticas, basaltos)		
<i>py</i>	Lavas y escorias del cono joven de El Pacayal (andesitas and dacitas)		
<i>eb</i>	Lavas y escorias de basaltos orientales		
<i>cd</i>	Flujo de lava dacítica de Chinameca		
<i>pi</i>	Ignimbrita Pacayal 4 (dacita-andesita)	}	
<i>oi</i>	Ignimbrita Pacayal 3 (dacita-andesita)		
<i>ci</i>	Ignimbrita Pacayal 3 (riodacita-dacita)		
<i>ti</i>	Ignimbrita Las Gemelas (dacita)		
<i>lp</i>	Lavas Loma Pacha (andesitas hornbléndicas)		
<i>lm</i>	Lavas El Limbo		
<i>bm</i>	Lavas y escorias intracaldericas Berlín (andesitas, andesitas basálticas y basaltos)		
<i>ri</i>	Ignimbrita Blanca Rosa (dacita)		
<i>gi</i>	Ignimbrita gris (andesita)		
<i>bi</i>	Ignimbrita negra (andesita)		
<i>uc</i>	Lavas Usulután (basaltos)	<i>ucl</i>	Lavas y lahares Usulután
<i>vc</i>	Lavas y escorias Volcancillo	<i>vcl</i>	Lavas y lahares Volcancillo
<i>ec</i>	Lavas El Tigre (basaltos/andesitas basalticas)	<i>ecl</i>	Lavas y lahares El Tigre
<i>cc</i>	Lavas Cimarrón (andesitas basalticas)	<i>ccl</i>	Lavas y lahares Cimarrón
<i>tc</i>	Lavas Taburete (basaltos)		
<i>oc</i>	Lavas Oromontique (basaltos)		
		<i>bc</i>	Brechas de colapso Buenaventura
<i>ps</i>	Lavas y escorias Portillo-Capules		
<i>vs</i>	Lavas Verde-Pelon		
<i>ms</i>	Lavas y escorias Manita		
<i>cs</i>	Lavas Chambala		
<i>mr</i>	Lavas rioliticas Moncagua		
<i>so</i>	Lavas y brechas Sihuatepeque		
<i>co</i>	Lavas de conos viejos El Zape		
<i>lo</i>	Lavas y brechas Lolotique (basaltos y andesitas)		
<i>bo</i>	Lavas y escorias del edificio viejo de Berlin (basaltos)		

Nota: Los limites en el mapa definen unidades demarcadoras del terreno que controlan la topografía y no necesariamente representan la geología expuesta en la superficie como por ejemplo corte de la superficie terrestre para vias de comunicación.

AGE

LAVAS

EPICLASTICS

IGNIMBRITES

TEPHRAS
(not mapped)At
BerlinAt
Chinameca

San Miguel

700 yr BP (EHs)

El Hoyo surges

Amarilla
ashes

Los Pirineos

scoria
fallsSan Miguel
scoria falls

Pacayal 4

Pacayal 3

Pacayal 2

Volcan fall

eb

sm

cd

fa ff

?

by py

lp

c2

Pacayal 1

lm

t2

Twins fall

bm

m

Blanca Rosa fall

50 ka (Twins)

75 ka (ri)

Mercedes scorias

Triunfo scorias

0.10 Ma (bm)

100 ka (gi)

oc

tc

cc

ec

vc

uc

bo

?

ecl

ucl

ccl

vcl

?

q2

dacitic fall beds

q1

0.10 Ma (oc)

0.15 Ma (ec)

0.22 Ma (uc)

ps

vs

ms

cs

bo

mr

bc

0.88 Ma (bo)

0.89 Ma (mr)

1.0 Ma (bo)

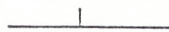
lo

co

so

1.3 Ma (bo)

1.4 Ma (bo)



Fault (tectonic)



Fault (volcanic collapse)

(inferred)

(inferred)



Vent



Crater outline



Surface hydrothermal area (active and fossil)



Outcrop examined



Geothermal well

see over for key

Table 1

núm.	NAME of SECONDARY VENT or ERUPTION	Type of edifice	Associated faults	AGE DETERMINATION	REFERENCE
	Los Chintos vent (lavas) and Boqueroncito	Scoria cone inside central crater of BV	N40W (lavas)	1917 AD	Larde y Arques, 1917; Sapper, 1925; Meyer-Abich, 1956
1	El Playón	Scoria cone	N40W	1658-59/1671 AD	Ximénez, 1721; Larde Arques, 1917; Larde y Larin, 1978; Meyer-Abich, 1956;
2	Loma de Grandes Bloques	Scoria cone	N40W	1575 AD End of XV century or XVI century	Lardé y Arqués, 1960; Sofield, 1998 Palacio, 1576; Larde y Larin, 1978
	TALPETATE II	Central crater BV	Distribution NNW (max. 4.4 km)	766 ± 34 BP (cal. 1214 -1285 AD)	own data
3	Nameless (close to Matazano)	Scoria cone	N40W		Sofield, 1998
3(bis)	Nameless (new cone)	Scoria cone	N40W	964 - 1285 AD	own data
	TALPETATE I (SAN ANDRES TUFF, SAT)	Central crater BV	Distribution W-SW (max. of 18.9 Km)	1031 ±29 BP (cal. 964 - 1040 AD) 800 - 1300 AD	own data Archaeometric (Hart, 1983)
4	Boca Tronadora	Fisural vent	N40W		Sofield, 1998
5	Laguna Ciega	Scoria cone	N40W		Miller, 1993; Sofield, 1998
6	Loma Caldera	Maar/Tuff cone	N40W	cal. 590±90 AD	Sheets, 1983; Miller, 1993; Sofield, 1998
7	Laguna Caldera	Scoria cone	N40W		Miller, 1993; Sofield, 1998
8	Cráter La Escondida	Explosion crater	N40W		Sofield, 1998
	Tierra Blanca Joven (TBJ), Ilopango Caldera			cal. 429±107 AD	Dull, R. et al., 2001 own data
9	Laguna de Chanmico	Maar	N65W		
10	Crater La Aurora	Tuff cone	N40W		
11	Cerro La Hoya	Scoria cone	N40W (SE)		
12	Resumidero	Tuff ring	N65W		
13	Jabalión	Explosion crater	N65W		Sofield, 1998
14	Plan del Hoyo	Scoria cone	N40W		
15	Boca del Jabali	Explosion crater	N65W		
16	Plan de la Laguna	Maar	N40W (SE)	cal. 791 - 933 BD	Amaroli et al., 1998
17	Las Granadillas	Maar	N65W		
18	Cráter Quezaltepeque	Tuff ring	sd		
19	Crater Lavas El Playón	Explosion crater	sd		
20	Plan de la Hoya	Tuff cone	sd		
21	Montaña Las Viboras	Scoria cone	sd		Sofield, 1998
22	El Cerrito	Scoria cone	sd		
23	Cerro 14 de marzo	Scoria cone	sd		
24	Sin nombre 2 (cerca del Matazano)	Scoria cone	N40W		

Table 2

STRATIGR. SEQUENCES		STRATIGRAPHIC LAYERS at ECAS (ID)		THICKNESS (cm)	DESCRIPTION	ERUPTIVE EVENT	AGE OF VOLCANIC EVENT	ECAS LEVEL (Chadler, 1983)	ARCHAEOLOGICAL PERIOD (Sharer, 1978)
UPPER SERIES		Current Soil			Brown clay and sand				HISTORIC 1500 AD-Present
		nd			Andesitic lavas and scoria cone	Lavas Boquerón and Boqueroncito	1917 AD		
	EL PLAYÓN SEQUENCE	Lacustrine deposits	0 - 15	Altered ash and Light brown fine indurated ash layers		Sedimentation within Zapotitán Lake	1671 AD	A	
		Upper Playón (UP)	20 - 70	Highly vesiculated black lapilli fall deposit (Pm= 2.5-3 cm). Internal bedding with 3 layers showing inverse grading and the upper portion showing fining upward. Lithic fragments of indurate light brown ash with leaf impressions and sporadic big altered white pumice (Lm= 6 cm) Light brown ash deposit showing deformation structures. Lower subunit is a fine ash layer, with different degrees of compaction but generally loose. Some fine laminations with accretionary lapilli. Traces of fossil plants. Upper subunit is a welded fine ash layer with plane and cross bedding laminations, and with lithics of milimetric size.		Big emission of ash		B	
		Intermediate Playón (IP)	9 - 12	Dark grey, normal grading, lapilli fall deposit. Highly vesiculated juvenile (Pm= 3.5-4 cm).The lower half usually presents lighter color. Top of the layer (3 cm) is indurated.		Emissions of ash		C	
		Lower Playón (LP)	10 -15			Scoria cone + AA lava flow		1658-59 AD	D
		nd (Loma de Grandes Bloques)		Basaltic-andesitic lavas		N40W fissural lavas	>1575 AD		LATE POSTCLASSIC 1200-1500 AD
		nd (Talpetate II)	10 - 100	Basal layer of massive indurated very fine ash. Alternation of indurated very fine ash layers with medium-coarse ash friable layers with accretionary lapilli.		BV central eruption ??	<1214 AD		
	TALPETATE I SEQUENCE	Paleosol	10-25	Dark brown soil, rich in organic matter with indurated fine ash fragments. Presence of pottery		Boquerón Volcano central eruption	cal. 964 - 1040 AD	E	EARLY POSTCLASSIC 900-1200 AD
		Talpetate I (Tpi)	8 - 60	Multicolor-purple, massive and indurated very fine ash layers at the base, with abundant traces of fossil plants. The remaining deposit formed by a collection of planar and cross low angle stratification laminations of very fine to fine indurated ash layers (mm to few cm thick), frequently with oxidized contacts between them, and massive very fine ash layers with				F	
		nd (TALPI fall)	30-50	Dark grey-black, normal grading, lapilli fall deposit. Highly vesiculated juvenile. Basaltic-andesitic composition					
	LOMA CALDERA SEQUENCE	Paleosol	20 - 30	Orange- dark brown soil with abundant organic matter and cultural remains (upper 15 cm)		Magmatic and hydromagmatic activity at Loma Caldera	cal. 590±90 AD	G	LATE CLASSIC 650-900 AD
		Loma Caldera surge (LCs)	3 - 14	Fine-grained, welded, sometimes laminated, grey-brow ash layer. Progressively thinner to the south where it becomes discontinuous. It does not appear in the central, western and southern sectors of the site.				G'	
		Loma Caldera fall (LCf)	10 - 30	Black, highly vesiculated lapilli poorly sorted and frequently altered (orange color). Pm=2-3 cm.					MIDDLE CLASSIC 400-650 AD
	TBJ	Paleosol	10 - 20	Poorly developed brown-orange soil, with frequent signs of remotion. Sporadic pottery remains.		Ilopango Caldera	cal. 429±107 AD	H	EARLY CLASSIC (PROTOCLASSIC) 250-400 AD
		Tierra Blanca Joven (TBJ)	25 - 60	Base pumice fall layer (4 cm. of maximum thickness, Pm= 3 cm). The remaining deposit is a fine-medium white ash layer, showing signs of being reworked.				H''	
LOWER SERIES		"Tierra Negra" Paleosol	40 - 60	Very dark-brown soil, rich in organic matter. It presents crop rows at the upper contact with TBJ. Abundant cultural remains (pottery, burials and stoves)		Chanmico Maar ?	¿?	I	LATE PRECLASSIC (TERMINAL) 400 BD-250 AD
		Fall deposit	20 - 40	Indurated ash fragments, altered pumice and oxidized lapilli in a brownish clay matrix. Low degree of compaction.				J	
		Ash and pumice tuff	20 - 25	Greenish-ocre indurated tuff of altered and rounded pumice with laminated fine ash fragments.					MIDDLE PRECLASSIC 900 BD-400 BD
		Paleosol	10	Brown sandy soil poor in organic matter with sporadic cultural remains and burials preliminary attributed to Middle Precassic		K			
		Fall deposit??	55	Indurated ash fragments, altered pumice and oxidized lapilli in a		L			
		Surge deposit	6	Indurated very fine to fine ash high brown ash. Batch layer					
		Paleosol	10	Brown soil with lents of sand. Abundant cultural remains (pottery) preliminary attributed to Preclassic.					
	Altered fall deposit	>36	Semiconsolidated very altered black lapilli in a brownish clay matrix. Altered due the contact with the phreatic level.						

Table 3

SAMPLE		TYPE OF SAMPLE	STRATIGRAPHIC POSITION	LOCATION	$\delta^{13}\text{C}^*$	CONVENTIONAL AGE ^{14}C years BP $\pm 1\sigma$	CALIBRATED AGE $\pm 2\sigma$ (CALIB 5.1©)	RELIABILITY	PONDERATION (CALIB 5.1©)
DF-C11	External rings of a charred trunk	Charcoal	Base contact of TALPETATE I with underlying soil	DF69	-28.2	770$\pm$55**	ca. 1156 DC - ca. 1304 DC	97.0%	2 samples 1031$\pm$29 BP (95%) (cal. 964 DC - cal. 1040 DC) (95%)
					-26.7	1002$\pm$35*	ca. 974 DC - ca. 1154 DC	100.0%	
DF-C12	External twigs of the charred trunk	Charcoal			-26.2	1094$\pm$52*	cal 854 DC - ca. 1025 DC	94.0%	3 samples 996$\pm$22 BP (95%) (cal. 990 DC - 1047 DC) (81%)
DF-C1M	Center of the trunk	Wood			-26.9	945$\pm$35*	cal 1020 DC - cal 1165 DC	100.0%	
DF-C2	Charcoal Flecks	Charcoal	Soil overlying Talpetate I	DF69	-26.6	766$\pm$34*	cal 1214 DC - cal 1285 DC	100.0%	
DF-C3	Animal bone	Bone	Soil underlying the "Green Tuff" at ECAS	DF47	-	nd			
DF-C4	Human bone	Bone	Soil underlying the "Green Tuff" at ECAS	DF47	-	nd			