Table 1 - Estimation of volcanic emplacement rate in the western TMVB and its uncertainties

The histogram of Figure 2B was constructed by dividing the volume of each geologic unit by the million of years that it spans according to the figures in the table below. Errors in the estimation of mean thickness, area and age range are the most significant elements that affect the estimation. Age range may be imprecise if available dates are from a part of a succession only. The assigned age range is our best estimate based on the position of the dated sample. Mean thickness and area accuracy depend on the number of field checkpoints and on the precision of elevation estimates in 1:50,000 scale maps. The latter is the only quantifiable error and is less than 25 m. Taking into account these limitations we have assigned a quality factor to each volume estimation.

The meaning of fields and the source of the data are as follows:

Geologic unit: unless otherwise specified the name refers to that used in the geologic map of Ferrari et al. (2000a). In many cases the unit has been divided in parts of lesser extent to ease the volume calculation. Rocks are arbitrarly referred to as mafic or silicic taking SiO_2 content = 57 % as a boundary.

Age: dates available in the literature and unpublished ages of L. Ferrari. The reference is reported for each unit. A compilation of published ages for the western TMVB is available in Ferrari et al. (2000a).

Rock type: it refers to the petrologic affinity of each volcanic unit. SR = Subduction related; OIB = Ocean Island Basalts; T = transitional from SR to OIB. This was assigned according to the most complete study available on the geochemistry of each unit. The relevant reference is reported.

Area: it was calculated using ArcView 3.1 Geographic Information System. Unless otherwise specified the source of data is the geologic map of Ferrari et al. (2000a) as originally elaborated by the author at 1:250,000 scale.

Mean thickness: arithmetic mean between average upper and lower surface of each unit. Upper surface is obtained by averaging the topographic surface (from 1:50.000 scale maps) if the unit is not buried. Lower surface is an average based on geologic contact located in the field.

Volume: Values reported in the literature were used whenever available. In the remaining cases it was calculated considering the unit as a tabular solid (area x mean thickness).

Quality factor: A = error of 10% or less; B = error of 10 to 25%; C = error of 25 to 40%

Geologic Unit	Age (Ma) and reference	Assigned age range (Ma)	Rocks type and reference	Area (km^2)	Mean thickness (m)	Volume (km^3) and quality factor	Comments
Late Miocene mafic lavas							
Cinco de Mayo basalts	8.9 ± 0.1 (Righter et al. 1995)	10 – 9	SR-T (Ferrari et al., 2000b)	590	400	236 B	Age from the upper part of the succession
Ceboruco basaltic buried succession	8.5 ± 0.2 (Ferrari et al., 2000b)	9.5 – 8.5	SR-T (Ferrari et al., 2000b)	400	600	240 C	The succession is not exposed. Mean thickness uncertain because based on one well only. Age from the lower half of the succession
Punta Mita basalts	10.2 ± 0.8 to 8.3 ± 0.6 (Gastil et al., 1979)	10 – 8.5	SR (Ferrari et al., 2000b)	115	150	17 B	Includes late Miocene basalts exposed from Punta Mita to Rincon de Guayabitos

Geologic Unit | Age (Ma) and reference | Assigned age range (Ma) | Rocks type and reference | Area (km^2) | Mean thickness | Volume (km^3) and | Comments

					(m)	quality factor	
San Cristobal basalts (excluding Los Altos de Jalisco)	10.2 ± 0.8 to 8.5 ± 0.1 (Nieto-Obregón et al., 1981 and 1985; Moore et al., 1994)	10.5 – 8.5	SR-T (Ferrari et al., 2000b)	2000	800	1600 B	The unit continues east of Guadalajara in the central TMVB. Only the part belonging to the western TMVB is considered here.
T O T A L						**2093**	
Latest Miocene-early Pliocene silicic lavas							
Guadalajara group	7.2 ± 0.3 to 3.2 ± 0.1 Ferrari unpublished; Gilbert et al. (1985)	7.5 – 3.5	SR Gilbert et al. (1985)	1350	300	405 A	
Jala-Juancata group	4.6 ± 0.2; 4.2 ± 0.1 Gastil et al. (1979; Righter et al. (1995)	7 – 4	SR Ferrari unpublished	1300	400	520 B	Ages from the upper part of the succession.
T O T A L						**925**	
Early Pliocene mafic lavas							
Guadalajara Basalts of Moore et al. (1994)	4.6 ± 0.1 to 3.7 ± 0.1 Gilbert et al. (1985); Moore et al. (1994)	4.5 – 3.5	OIB Moore et al. (1994)	100	150	15 A	Area and thickness from unpublished geologic mapping by Ferrari and co-workers
Hostotipaquillo - El Salvador basalts (name given in this work)	4.0 ± 0.1 to 3.2 ± 0.1 Moore et al. (1994); Gilbert et al. (1985); Nieto et al. (1985)	4 – 3	OIB Moore et al. (1994)	245	200	49 A	Area and thickness from unpublished geologic mapping by Ferrari and co-workers
Jalotemba plateu, Cerro Tecuitato, Cerro Las Dos Righter et al. (1995)	3.4 ± 0.1 to 3.1 ± 0.1 Righter et al. (1995)	3.5 – 3	OIB Righter et al. (1995)	210	150	31.5 A	
Cerro Tio Cleto, Cerro La Virgen, Llano Grande plateau Righter et al. (1995); Righter and Carmichael (1992)	3.6 ± 0.2 to 3.4 ± 0.1 Righter et al. (1995); Righter and Carmichael (1992)	3.5 – 3	OIB Righter et al. (1995); Righter and Carmichael (1992)	175	200	35 A	Volume for Llano Grande plateau and Cerro Tio Cleto is 31 km^3 according to Righter and Carmichael (1992)
T O T A L						**130.5**	
Ayutla volcanic field Righter and Rosas Elguera (in press)	4.5 ± 0.2 Righter and Rosas Elguera, in press	5 – 4	SR Righter and Rosas Elguera, in press	800	150	120 A	This volcanic field is not included in the geologic map of Ferrari et al. (2000a). Data were taken from unpublished 1:50,000 scale geologic maps by Rosas Elguera

Geologic Unit	Age (Ma) and reference	Assigned age range (Ma)	Rocks type and reference	Area (km^2)	Mean thickness (m)	Volume (km^3) and quality factor	Comments
Atemajac area Righter and Rosas Elguera (in press)	5.2 ± 0.4 to 4.2 ± 0.1 Allan (1986); Rosas Elguera et al. (1997)	5 – 4	SR Allan (1986)	1250	300	375 B	Include most of the alkaline lavas exposed in the Sierra de Tapalpa
San Pedro – Ceboruco graben Petrone (1998)	4? to 3 Ferrari unpublished; Petrone et al. in press	4– 3	SR Petrone (1998)	250	250	62.5 A	
T O T A L						**557.5**	
Pliocene-Quaternary mafic lavas							
Alkali basalts from cinder cones in the Sangangüey area Nelson and Carmichael (1984)	2.6 - late Pleistocene (Ferrari et al., 1997)	2.5 – 0	OIB? Nelson and Carmichael (1984)	270	100	27 B	Thickness difficult to evaluate because of lack of complete exposure
Mesa Santa Rosa Nixon et al. (1987)	2.5 ± 0.1 - 0.9 ± 0.1 Nieto et al. (1985) Nixon et al. (1987)	2.5 – 1	OIB Moore et al. (1994)	275	250	68.75 A	
Cerro La Laja (Righter and Carmichael (1992)	0.67 ± 0.04 Righter and Carmichael (1992)	1 – 0	OIB Righter and Carmichael (1992)	50		10 A	Volume according to Righter and Carmichael (1992)
Cerro El Rosario (Righter and Carmichael (1992)	0.64 ± 0.1 Righter and Carmichael (1992)	1 – 0	OIB Righter and Carmichael (1992)	71		7 A	Volume according to Righter and Carmichael (1992)
Mesa Los Charcos (Righter et al. 1995)	-	1 – 0	OIB Righter et al. (1995)	37	100	4 A	No ages available. Age inferred from field aspect and stratigraphy
Cerro Grande shield volcano Ferrari et al. (1997)	1.1 ± 0.3 Ferrari et al. (2000a)	1.5 – 1	OIB Righter et al. (1995)	97	150	14.5 A	Area and thickness from unpublished geologic mapping by Ferrari and Petrone
Cerro El Devisadero, Cerro Palmoso (Righter et al. 1995)	1.5 ± 0.03; 0.9 ± 0.2 Righter et al. (1995)	1.5 – 1	OIB Righter et al. (1995)	80	150	12 A	
T O T A L						**143.3**	

Geologic Unit	Age (Ma) and reference	Assigned age range (Ma)	Rocks type and reference	Area (km^2)	Mean thickness (m)	Volume (km^3) and quality factor	Comments
Calc-alkaline basalts and andesite from cinder cones in the Sangangüey area Nelson and Carmichael (1984)	2.6 - late Pleistocene (Ferrari et al., 1997)	2.5 – 0	SR Nelson and Carmichael (1984)	490	100	49 B	Thickness difficult to evaluate because of lack of complete exposure
San Sebastian area Lange and Carmichael (1991)	1.5 ± 0.1 – Holocene Lange and Carmichael (1991)	1.5 – 0	SR Lange and Carmichael (1991)	213	120	25.5 B	
Mascota area Lange and Carmichael (1990)	Late Pleistocene - Holocene	0.5 – 0	SR Lange and Carmichael (1990)	240	120	29 B	
Los Volcanes area Wallace and Carmichael (1989; 1992)	3.3 ± 0.14 – 1.7 ± 0.2 Wallace and Carmichael (1989; 1992)	3.5 – 1.5	SR Wallace and Carmichael (1989; 1992)	530	150	79.5 B	
Cerro Alta Vista, Volcán Ceboruco Righter et al. (1995)	-	0.5 – 1	SR Righter et al. (1995)	45	130	5.85 B	No ages available. Age inferred from field aspect and stratigraphy
Tepic-Mecatán area (Subduction related lavas west and southwest of Volcán San Juan)	Pliocene	4 - 2	SR Luhr (2000)	700	250	175 B	No ages available. Age inferred from field aspect and stratigraphy
San Pedro – Ceboruco graben Petrone (1998)	2.5 - 0 Petrone et al. in press	2.5 – 0	SR Petrone (1998) and this work	300	120	36 A	
Agua Zarca, Amajaquillo, La Cienega Righter and Carmichael (1992)	2.9 ± 0.07 – 2.2 ± 0.1 Righter and Carmichael (1992)	3 – 2	SR Righter and Carmichael (1992)	380	200	76 B	
Cocula – San Marcos area	1.44 ± 0.1 - 0.65 ± 0.2 Allan (1986)	1.5 – 0.5	SR Allan (1986)	170	150	25.5 B	
Southern Guadalajara volcanic chain Luhr and Lazaar (1985)	-	1.5 – 0.5	SR Luhr and Lazaar (1985)	350	120	42 A	No ages available. Age inferred from field aspect and stratigraphy
Cinder cones around Tequila volcano	-	1.5 – 0.5	SR Ferrari unpublished	180	120	21.6 A	No ages available. Age inferred from field aspect and stratigraphy
T O T A L						**572.01**	

Geologic Unit	Age (Ma) and reference	Assigned age range (Ma)	Rocks type and reference	Area (km^2)	Mean thickness (m)	Volume (km^3) and quality factor	Comments
Late Pliocene-Quaternary silcic lavas							
Ahuisculco group	2.8 ± 0.2 Rosas Elguera et al. (1997)	3.5 – 2.5	SR?	260	300	78 A	No chemical analyses available
Cerro Chicharron, Cerro Bailadores, Los Pueblitos	3.0 ± 0.1 - 1.4 ± 0.5 Gilbert et al. (1985) Spinnler et al. (1993)	3 – 1	SR Gilbert et al. (1985)	70	70	49 B	
Tequila – Hostotipaquillo domes	2.6 – 0.5 Wallace and Carmichael (1984) Ferrari unpublished	2.5 – 0.5	SR Wallace and Carmichael (1984)	630	300	189 A	
San Pedro – Ceboruco graben Petrone (1998)	2.3 ± 0.5 – 0.1 Gastil et al. (1979) Ferrari et al. (2000a)	2.5 – 0	SR Petrone (1998)	130	130	17 A	
La Primavera caldera Mahood, (1981)	~0.1 Mahood, (1981)	0.5 – 0	SR?			35	Volume according to Mahood, (1981)
T O T A L						**290**	
Quaternary Stratovolcanoes							
Tequila	< 0.22	0.5 – 0	SR			45	Volume and age according to Wallace and Carmichael (1994)
Ceboruco	< 0.6	0.5 – 0	SR			70	Volume and age according to Nelson (1980)
Tepetiltic	< 0.6	0.5 – 0	SR			30	Volume and age according to Ferrari et al. (1997)
Sangangüey	< 0.4	0.5 – 0	SR			40	Volume and age according to Nelson and Camichael (1984)
Las Navajas	< 0.6	0.5 – 0	SR			25	Volume and age according to Nelson and Hegre (1990)
San Juan – Cerro Alto	Holocene	0.1 – 0	SR			60	Volume and age according to Luhr, (2000)
Colima (Nevado+Fuego)	< 1 Ma	1 – 0	SR			700	Volume and age according to Robin et al. (1987)
T O T A L						**970**	

Table 2 - Rapresentative chemical and normative analysis of studied rocks

Sample	SPC 83	SPC 82	SPC 74	SPC 155	SPC 15	SPC 10	GC6-325
Group	CA	CA	Na-alk	Na-alk	Tran.	Tran.	Tran.
SiO_2	57.09	57.15	46.39	48.72	53.50	51.01	50.01
TiO_2	0.70	0.70	2.39	1.93	1.79	1.56	2.03
Al_2O_3	19.45	19.15	17.78	16.95	17.97	19.29	15.23
Fe_2O_3	1.48	1.88	8.26	4.31	3.48	1.60	11.87
FeO	4.00	3.68	2.58	4.58	5.80	6.68	0.00
MnO	0.09	0.09	0.18	0.16	0.16	0.14	0.18
MgO	4.23	4.14	6.63	7.4	3.48	5.61	5.64
CaO	7.29	7.33	10.80	8.81	7.09	8.20	7.32
Na_2O	3.95	4.18	3.05	3.38	4.52	3.75	3.58
K_2O	0.99	0.97	0.95	1.51	1.28	1.14	1.36
P_2O_5	0.09	0.09	0.41	0.48	0.46	0.39	0.45
LOI	0.64	0.65	0.57	1.05	0.48	0.63	2.34
V	131	130	235	197	194	200	226
Cr	45	43	165	318	23	71	89
Co	24	22	41	33	23	33	40
Ni	31	34	78	139	6	46	73
Cu	15	17	43	37	23	29	35
Zn	57	61	84	80	106	83	109
Rb	4	18	14	14	10	6	13
Sr	718	712	530	456	739	884	481
Y	24	44	31	31	25	21	29
Zr	73	71	176	231	160	155	212
Nb	3	4	37	37	17	14	22
Ba	409	375	229	217	1054	617	499
La	24	38	26	23	25	18	22
Ce	29	18	57	50	57	49	63
Nd	25	27	29	bdl	34	28	33
Pb	5	4	6	3	11	8	8
qz	6.18	5.40	-	-	-	-	-
or	5.86	5.80	5.70	9.11	7.63	6.77	8.32
ab	33.67	35.64	20.60	28.10	38.52	31.95	31.36
an	32.68	30.86	32.42	27.19	25.13	32.66	22.22
ne	-	-	3.00	0.60	-	-	-
di	2.58	4.23	15.67	11.56	6.06	4.69	10.17
hy	16.46	15.49	-	-	16.01	9.49	14.33
Ol	-	-	15.11	16.90	0.44	8.97	6.43
mt	1.03	1.04	1.94	1.66	1.72	1.57	2.12
il	1.34	1.34	4.60	3.74	3.42	2.98	3.99
ap	0.21	0.21	0.96	1.14	1.07	0.92	1.07

CA: Calc-alkaline; Na-alk: Na-alkaline; Tran.: transitional group. Major elements determined by XRF; MgO, FeO, Na2O and LOI by traditional wet chemical methods following the method of Franzini et al. (1972). Trace elements were determined by XRF. bdl: below detection limit

Appendix - Estimation of crustal stretching in the western Trans-Mexican Volcanic Belt

To estimate the amount of extension in the western Trans-Mexican Volcanic Belt we use the area-balance method described by Groshong (1994) (Fig. A). The amount of extension was estimated along two profiles perpendicular to the extensional structures of the Tepic-Zacoalco rift. The area vertically ruled is equal to the gray one. The figure shows the most consistent solutions according to the geology of the region. The geologic section in the Zacoalco profile was proposed by Rosas-Elguera et al. (1997) and later validated by the seismological study of Pacheco et al. (1999). The geologic section of the Ceboruco profile is from Ferrari et al. (1997) and is constrained by the results of the CB1 well drilled by Comisión Federal de Electricidad south of Ceboruco volcano (see Ferrari et al., 2000b). Dashed lines represent inferred faults at depth. RRE is the regional reference level that is our best estimate of the topographic surface before extension.

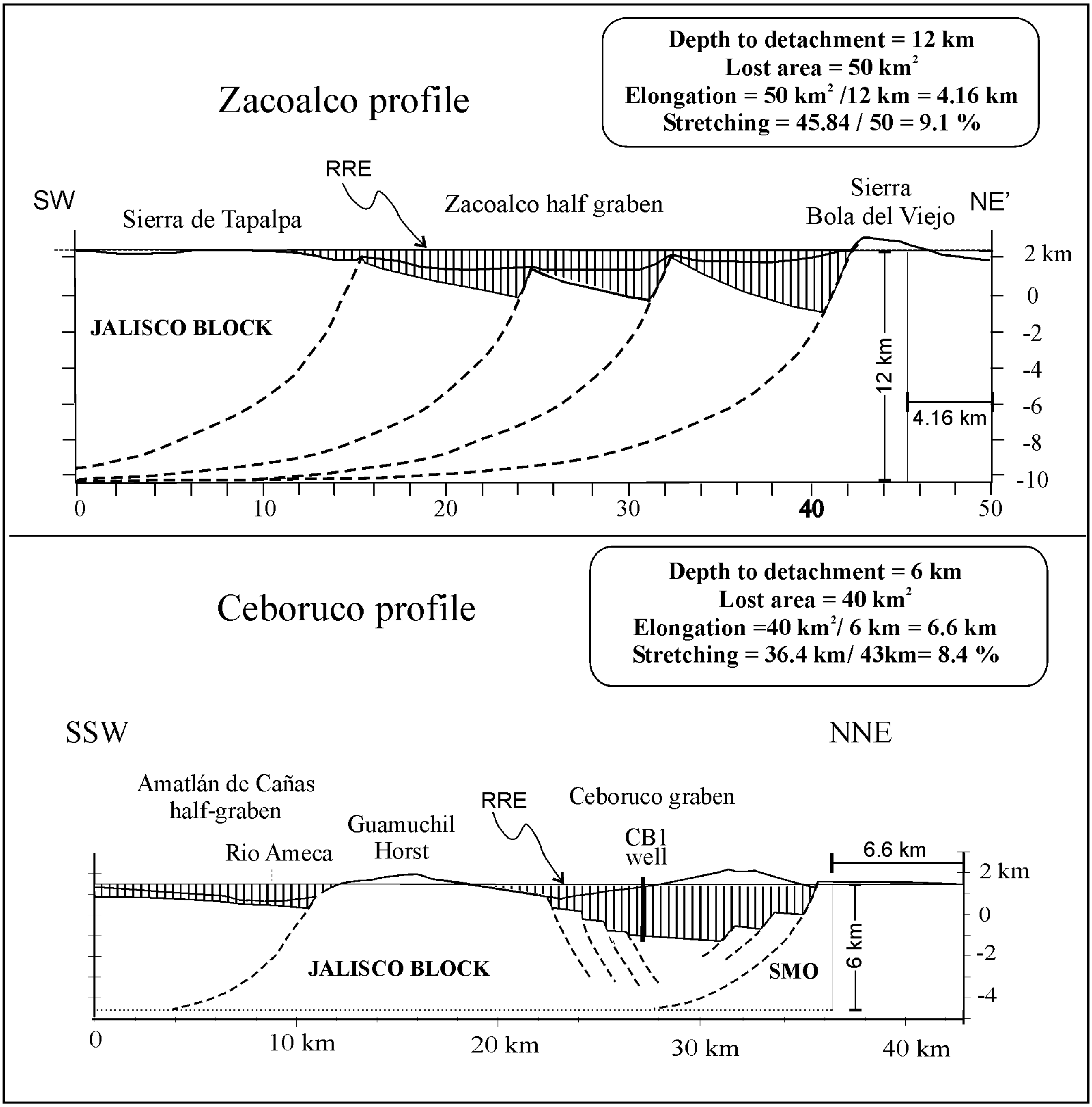

Figure A

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