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THE GUATEMALA EARTHQUAKE OF 1816 ON THE CHIXOY-POLOCHIC FAULT

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Abstract

Forty historical documents have been found which describe a previously unknown very large earthquake on 22 July 1816. This event occurred along the strike-slip boundary between the Caribbean and North American plates in Guatemala and southern Mexico. Modified Mercalli intensities are estimated from these accounts, and a rough isoseismal map is constructed. The damage pattern indicates that the causative fault was the left-lateral Chixoy-Polochic fault for which no damaging earthquake has previously been reported. Damage of Modified Mercalli intensity VII or greater covered an area of at least 13,000 km^2, extending over 340 km from Alta Verapaz province in Guatemala westward to San Cristobal las Casas, in Chiapas, Mexico. The area of intensity VII indicates a moment of 1 × 10^{28} dyne-cm, while the estimated length of the intensity VII isoseismal indicates a more likely figure of 3.5 × 10^{27} dyne-cm, or an equivalent magnitude (M_w) of 7$\frac{1}{2}$ to 7$\frac{3}{4}$. The reported aftershock sequence is compatible with an earthquake in this magnitude range. These data demonstrate that the Chixoy-Polochic fault is currently an active part of the Caribbean-North American plate boundary and is capable of producing very large earthquakes.

Introduction

The strike-slip plate boundary between the North American Plate and the Caribbean Plate crosses Guatemala westward from the Caribbean Sea into Chiapas, Mexico (see Figure 1). Within Guatemala, the plate boundary is composed primarily of two subparallel, left-lateral, strike-slip faults, the Chixoy-Polochic fault to the north and the Motagua fault to the south. Both faults can be traced along dramatic fault-controlled river valleys about 40 to 50 km apart, each with maximum vertical relief of over 1500 m. The Motagua fault ruptured in the 1976 Guatemala earthquake of magnitude (M_w) 7.5 in which over 26,000 people died (Espinosa, 1976). No damaging earthquake has previously been reported for the Chixoy-Polochic fault.

The Chixoy-Polochic fault separates predominantly sedimentary rocks to the north from igneous and metamorphic rocks to the south. Burkart (1978) estimated about 132 km of total offset since the middle Miocene. Schwartz *et al.* (1979) reported Quaternary faulting along the eastern portion of the fault. Along the western portion of the fault, Anderson *et al.* (1973) suggested a total Quaternary displacement of at most a few kilometers while Kupfer and Godoy (1967) suggested a total holocene displacement of a 100 to 122 m. Harlow (1976) first detected microseismicity on the fault with a portable seismograph operated at Chiantla (see Figure 2 for locations of towns mentioned in the text). Since then, the Guatemala national seismograph network (White and Harlow, 1978; INSIVUMEH, 1979, 1980, 1981) and studies near proposed dams (Woodward-Clyde Associates, 1979; HYDROCHULAC, 1982a, b) have detected microearthquakes along the fault with magnitude (M_L) up to 4+. No earthquakes with a magnitude (M_L) over 5 have ever been detected by any of the local networks and no damaging earthquakes had been reported for this fault. Consequently, it was not known if the Chixoy-Polochic fault is capable of producing very large earthquakes, whether it only slips aseismically, or whether the regional stresses are currently being accommodated only by slip along the Motagua fault.

The purpose of this paper is to report documentary evidence for a very large previously unknown earthquake on 22 July 1816 that was undoubtedly caused by the rupture of the Chixoy-Polochic fault. The data comes from 40 newly discovered historical documents that describe widespread damage covering at least 13,000 km^2. This earthquake is of unique value for seismic risk and hazard mapping since it is now the only very large earthquake known for this fault.

DOCUMENTATION

Published reports of historical earthquakes in Guatemala include earthquakes as early as 1526 (see, e.g., Montessus de Ballore, 1888; Sapper, 1925; Diaz, 1930; Vassaux, 1969). These reports consist mostly of lists of dates of destructive earth-

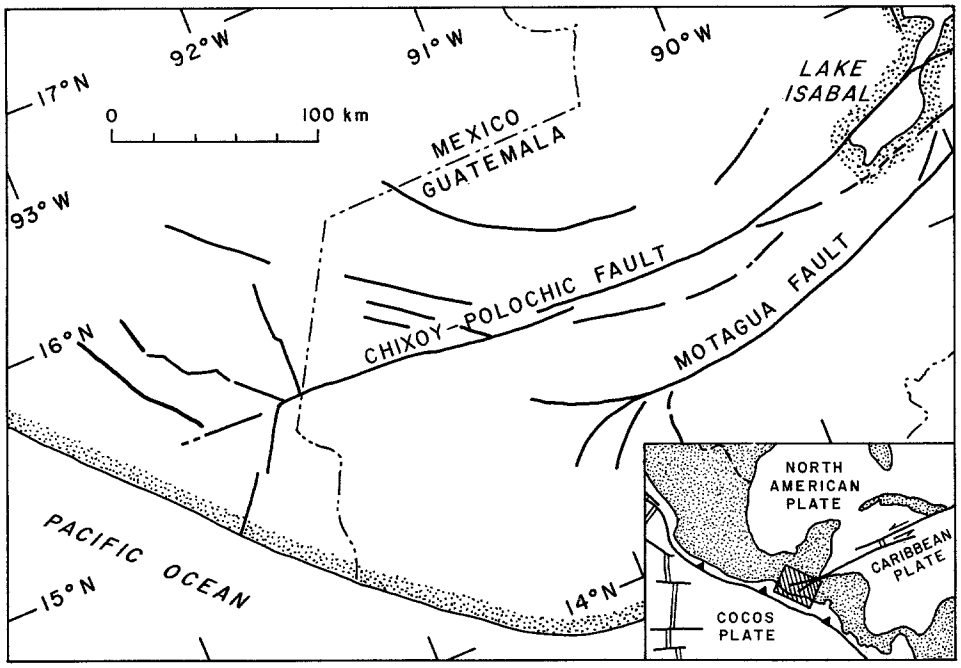

FIG. 1. Location map of major faults in central Guatemala and southern Chiapas (modified from Muehlberger and Ritchie, 1975). *Inset* shows study area and the plate tectonic setting of the region.

quakes, or give at most brief anecdotal information, and as such are completely inadequate for determining rupture location or size. In conducting an archival search for primary accounts of historical earthquakes in Guatemala, 40 manuscripts were found that describe widespread damage caused by an earthquake on 22 July 1816 not listed in any of the published literature. In many of these manuscripts, it is referred to as the earthquake of Santa Maria Magdalena, having occurred on the day of Saint Mary according to the calender of the Roman Catholic Church. It may seem strange that such a large earthquake was overlooked by previous investigators but the probable reason is that it did not cause much damage in any of the three largest cities, i.e., Guatemala City, Antigua, and Quetzaltenango, and merely "felt" earthquakes are too common to list (for example 195 earthquakes were felt in Guatemala City between 1960 and 1975 alone; Ing. Eddy Sanchez of INSUVUMEH, Guatemala, written communication, 1981).

Table 1 is a list of the documents in order of reporting location from west to east.

With the exception of document 14, all of the documents are official communications between various functionaries of Spanish-colonial Guatemala, which at the time also included the state of Chiapas, Mexico. Two of the most comprehensive and interesting documents, numbers 4 and 6, were parts of reports of the President of Guatemala to the King of Spain. The rest are petitions from the mayors or priests of individual towns or parishes (clusters of a few towns) requesting tax relief or reconstruction funds.

The Appendix contains a more detailed description of each document, although the prohibitive cost of transcribing the documents into modern Spanish and

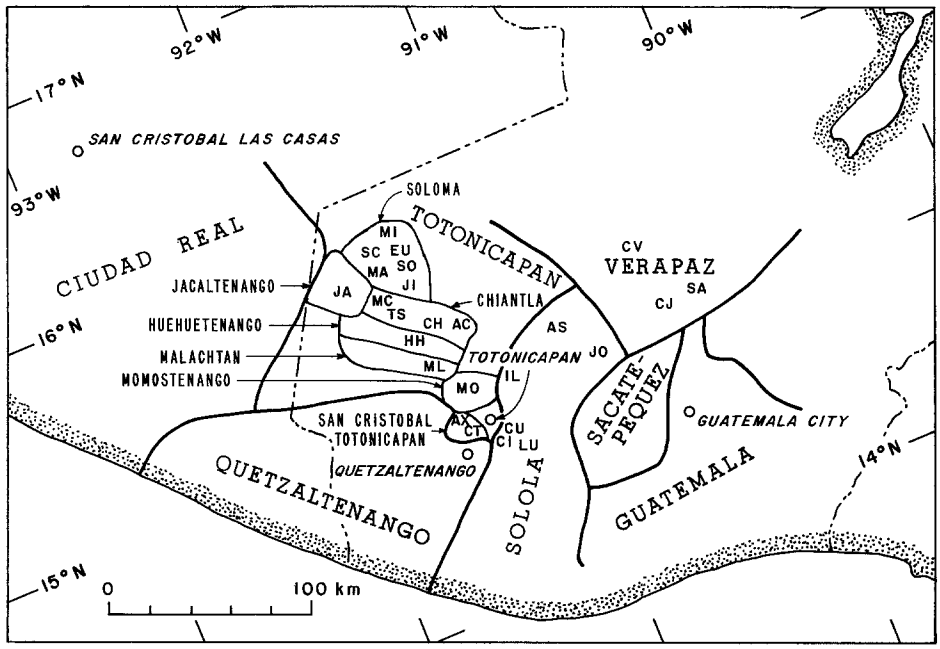

FIG. 2. Location map of towns, parishes, and province boundaries of 1816. Parishes were groups of 2 to 6 towns, and their boundaries are indicated by thin lines. Heavy lines indicate the province boundaries in 1816. Dashed lines indicate current international boundaries. From northwest to east the abbreviations are as follows: SO, Soloma; EU, Santa Eulalia; JI, San Juan Ixcoy; MA, San Miguel Acatan; SC, San Sebastian Coatan; MI, San Mateo Ixtatan; JA, Jacaltenango; CH, Chiantla; AC, Aguacatan y Chalchitan; TS, Todos Santos Cuchmatan; MC, San Martin Cuchumatan; HH, Huehuetenango; ML, Malactan; MO, Momostenango; TO, San Miguel Totonicapan; CT, San Cristobal Totonicapan; AX, San Andres Xecul; CU, Santa Catalina Utatlan; CI, Santa Catarina Ixtahuacan; LU, Santa Lucia Utatlan; IL, San Antonio Ilotenango; AS, San Andres Sacabaja; JO, Santa Maria Joyabaj; SA, Salama; CJ, San Miguel Chicaj; CV, San Cristobal Verapaz.

translating into English permitted the full reproducing of only a few of the documents. For the rest, brief quotes or abstracts are given. The Appendix also contains the archival source and document call number for each document.

INTENSITY ESTIMATES

Table 2 lists the intensity estimates for those places mentioned in the documents. When a document refers to a "parish", the several towns that comprise the parish are given in parentheses. Towns and parish boundaries listed in Table 2 are shown in Figure 2. A very brief summary of the reported disturbances and the appropriate references are also given. Modified Mercalli intensities, 1956 version (Richter, 1958, p. 137), have been assigned based primarily on damage to adobe churches. There

TABLE 1

LIST OF DOCUMENTS

Document	Description	Date Written
(1)	Report from mayor of San Cristobal las Casas, Chiapas, Mexico describing damage.	1817
(2)	Note from President of the Audiencia of Guatemala verifying receipt of letter from the governor of Totonicapan Province.	08/03/1816
(3)	Confirmation of the visit of the governor of Totonicapan Province to the President.	08/21/1816
(4)	Report from governor of Totonicapan Province to the president.	08/21/1816
(5)	Reply to governor of Totonicapan Province from the president.	08/26/1816
(6)	Report from President of Guatemala to the king of Spain.	10/03/1816
(7)	Tax relief petition from priest of Chiantla Parish to the governor.	1816
(8)	Petition from the priest of Chiantla Parish for church reconstructions funds.	1816
(9)	Tax relief petition from the mayor of Chiantla to the governor.	1817
(10)	Tax relief petition from the mayor of Aguacatan and Chalchitan to the governor.	1816
(11)	Tax relief petition from the mayor of Todos Santos Cuchimatan to the governor.	1817
(12)	Tax relief petition from priest of Huehuetenango to the governor.	1816
(13)	Tax relief petition from the mayor of Huehuetenango to the governor.	1817
(14)	Monograph of the Department of Huehuetenango	1954
(15a, b, c, d, e)	Petition from the mayor of San Miguel Totonicapan for church reconstruction funds.	1816–1817
(16)	Tax relief petition from the mayor San Miguel Tontonicapan to the governor.	1818
(17a, b, c)	Petition from the mayor of San Cristobal Totonicapan for church reconstruction funds.	1816–1817
(18)	Petition from the mayor of San Andres Xecul for church reconstruction funds.	1816
(19)	Report from the mayor of Momostenango	1816
(20a, b)	Petition from the mayor of Momostenango for church reconstruction funds.	1816
(21)	Report from the President to the King of Spain describing damage at Quezaltenango.	1818
(22)	Petition from the mayor of Santa Catalina Utatlan for church reconstruction funds.	1817
(23)	Petition from the mayor of Santa Catarina Ixtahuacan for church reconstruction funds.	1819
(24)	Petition from the mayor of Santa Lucia Utatlan for church reconstructions.	1816
(25)	Petition from mayor at San Antonio Ilotenango for church reconstruction funds.	1821
(26)	Petition from the mayor of San Andres Sacabaja asking for church reconstruction funds.	1816
(27)	Petition from priest of Santa Maria Joyabaj asking for church reconstruction funds.	1816
(28)	Tax relief petition from the mayor of Santa maria Joyabaj to the governor.	1817
(29)	Petition from the priest of San Cristobal Verapaz asking for church reconstruction funds.	1818
(30)	Tax relief petition from the mayor of Salama to the governor explaining damage.	1817
(31)	Petition from priest of Salama to the governor asking for reconstruction funds.	1816
(32)	Tax relief petition from the mayor of San Miguel Chicaj asking to repair church.	1820

TABLE 2

LIST OF INTENSITY ESTIMATES

Location	Intensity	Description	Reference*
MEXICO			
Chiapas			
San Cristobal las Casas	7	One of three cathedral towers fell, central arches split open	1
GUATEMALA			
Huehuetenango Department			
Soloma Parish included	9	"In the parish of Soloma . . . not a church, convent, or house that hasn't fallen to the ground."	3, 4, 6
Soloma,	9		
Santa Eulalia,	9		
San Juan Ixcoy,	9		
San Miguel Acatan,	9		
San Sebastian Coatan,	9		
San Mateo Ixtatan	9		
Jacaltenango parish (included Jacaltenango, Concepcion, Petetlan, Santa Ana Huista, San Antonio Huista, San Marcos Jacaltenango)	8–9	"knocked down churches, convent"	4
Chiantla parish	7–8	"the 4 churches of parish ruined"	4, 7, 8
Chiantla	7–8	"church ruined"	7, 9
Aguacatan e Chalchitan	7–8	"church and priest's quarters completely ruined"	7, 10
Todos Santos Cuchumatan	8–9	"main chapel, vestry, bell tower collapsed"	8, 11
San Martin Cuchumatan	7–8	"need to replace the ruined church"	7, 8
Huehuetenango parish	7–8	"need to rebuild the churches of the parish"	4, 12
Huehuetenango (included San Lorenzo, San Sebastian, San Pedro Necta, Santiago Chimaltenango, San Juan Atitan, Santa Isabel, Santo Domingo)	8–9	Church and convent collapsed	13
Totonicapan Department			
Malacatan parish (included Malacatancito, Santa Barbara, Colotenango, Ixtaguacan, San Gaspar, Ixchil, San Ramon)	8–9	"knocked down churches, convent, and houses"	4, 14
Santiago Momostenango parish	8–9	"knocked down churches, convent"	4
Momostenango (parish included Santa Maria Chiquimula, San Bartolome Aguascalientes)	7–8	"church ruined"	19a, b, 20
San Cristobal parish	8–9	"knocked down churches, convent"	4
San Cristabal Totonicapan	7	"need to repair damaged church"	17a, b, c
San Andres Xecul (parish included Olintepeque)	7–8	"need to rebuild damaged church"	18
San Miguel Totonicapan parish	8–9	"knocked down churches, convent"	2, 4, 6
San Miguel Totonicapan (parish also included San Francisco El Alto)	7–8	"church ruined"	15a–e, 16
Quezaltenango Department			
Quezaltenango	6–7	church damaged, "not major damage"	6, 21

TABLE 2—*Continued*

Location	Intensity	Description	Reference*
Solola Department			
Santa Catalina Utatlan	7–8	"need to rebuild ruined church"	22
Santa Catarina Ixtahuacan	7–8	"church completely ruined"	23
Santa Lucia Utatlan	7–8	"church completely ruined"	24
Quiche Department			
San Antonio Ilotenango	7	"church damaged"	25
San Andres Sacabaja	7–8	"rebuild ruined church from ground up"	26
Alta Verapaz Department			
Santa Cruz Verapaz	7–8	"Half of church dome collapsed"	29
Verapaz province (included San Cristobal Verapaz, Santo Domingo Coban, San Pedro Carcha, San Juan Chamelco, Tactic, Tamahu, Tucuru	7–9	"Most of the houses and public buildings fell the ground . . . throughout the entire province of Verapaz."	6
Baja Verapaz Department			
San Mateo Salama	8	Destroyed the town hall and facade of the church	30, 31
San Miguel Chicaj	7–8	"church damaged"	32
Verapaz province (also included Santiago Cubulco, San Pablo Rabinal, Santa Cruz del Chol)	7–9	"most of the houses and public buildings fell to the ground . . . throughout the entire province of Verapaz."	6
Zacatepequez Department	≤6	no damage reports encountered	
Guatemala Department			
Guatemala City	6	"cracks in buildings"	6

* See document numbers in Table 1.

The intensity values listed in Table 2 are shown in Figure 3. Possible reporting sources were very few to the east and to the west of the reported damage and were nonexistent to the north. Immediately to the south of the area of reported damage, however, lie the southern Guatemala highlands where the population density was greatest and the towns were accustomed to reporting to the capital. I have drawn as open circles those towns in the highlands for which no earthquake damage reports were found for the 1816 earthquake but which reported damage from at least two other earthquakes prior to 1816. The absence of reported damage to these towns in 1816 indicates that damage there was probably very minor to nonexistent and permits an estimate of the southern extent of known damage. Because data is so sparse, I have drawn only this southern limit of damage and assume that it also approximates the limit of intensity VII.

are indications from the 1976 earthquake that the adobe derived from limestone terranes is rather weak (A. Espinosa, oral communication, 1981), so I have assumed that all adobe construction is of weak masonry, or Masonry D in the scale classification of Richter.

Many of the summaries are necessarily vague such as "church damaged" or

"church ruined" and reflect as closely as possible the wording of the original documents. By comparison with the damage caused to old adobe churches by the 1976 Guatemala earthquake, I have correlated the most common phrases with Modified Mercalli intensity as follows

"church damaged"	intensity VII
"damaged church needs rebuilding"	intensity VII
"church ruined", "completely ruined"	intensity VII–VIII
"knocked down" church, convent and houses	intensity VIII–IX
"there was not a church, convent, or house that hadn't fallen to the ground."	intensity IX

Damage Distribution Versus Known Faults

In the eastern portion of the damaged area, the intensity estimates rely heavily on document number 6 which states that "churches and houses collapsed . . . in the entire province of Verapaz." The Province of Verapaz encompassed the 14 towns of the present departments of Alta Verapaz and Baja Verapaz and generally straddles the Chixoy-Polochic fault. Although no towns were specified in this document, three other documents confirm damage of intensity VIII to at least the western portion of both departments.

Damage in western Guatemala generally straddles the Chixoy-Polochic fault, although the most severe damage of intensity IX apparently occurred 30 to 45 km north of the fault in the Soloma area. Here in the six continguous towns that composed the parish of Soloma, all churches, priest's quarters, town halls, and houses collapsed, and at least 23 people were killed. Fifty-seven hills were said to have "broken or split open," probably landslides, burying the terraced farmland and the barns filled with the harvest. The higher intensities in the west could be due to a westward propagating rupture such as occurred in the 1976 earthquake.

The westernmost damage reports come from San Cristobal las Casas, in Chiapas, Mexico. There the old bell tower and central arches of the cathedral were severely damaged, indicating intensity VII, and an aftershock not reported in Guatemala caused additional damage to the church. San Cristobal las Casas lies about 150 km northwest from the nearest reported damage near the Guatemala border, but the lack of other damage reports from Mexico is almost certainly due to the scarcity and remoteness of towns in this region, as can be seen in Figure 3. The town is about 100 km, from the western terminus of the Chixoy-Polochic fault, as mapped by Muehlberger and Ritchie (1975). NW-trending reverse faults splay from the Chixoy-Polochic fault according to McBirney (1963) and some of these continue into Mexico to within 30 km of San Cristobal according to Lopez-Ramos (1975). Whether or not the damage at San Cristobal las Casas could have been caused by secondary faulting along these faults, similar to the secondary faulting which caused damage at Guatemala City during the 1976 earthquake, is unknown.

Seismic Moment and Magnitude

One approach to estimating the seismic moment M_0 from this sparse data set is to compare the area of known damage in 1816 to that of the 1976 Guatemala earthquake. Although the known damage in 1816 is uncontrolled to the north, and

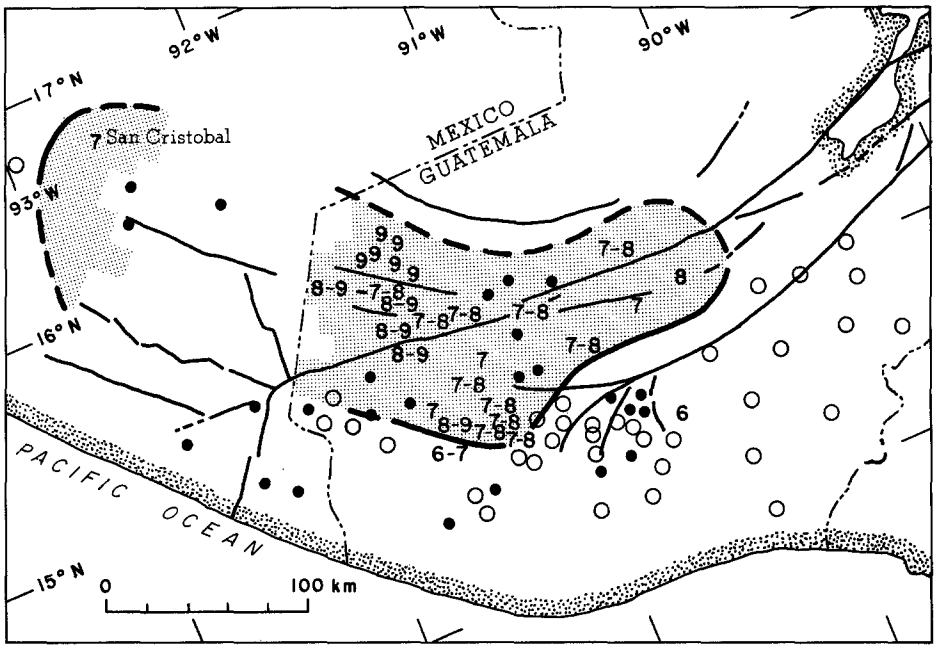

FIG. 3. Map of estimated Modified Mercalli intensity for the 1816 earthquake. Numbers indicate estimated modified Mercalli intensities taken from Table 2. Open circles indicate towns for which no damage reports were found for the 1816 earthquake but which have reported damage from at least two earthquakes prior to 1816, and therefore may be indicative of intensity VI or less. Dots indicate other towns that existed in 1816 for which no earthquake damage reports were found. Note that very few towns existed immediately to the west of the Mexico-Guatemala border, and none existed to the north of the reported damage in Guatemala.

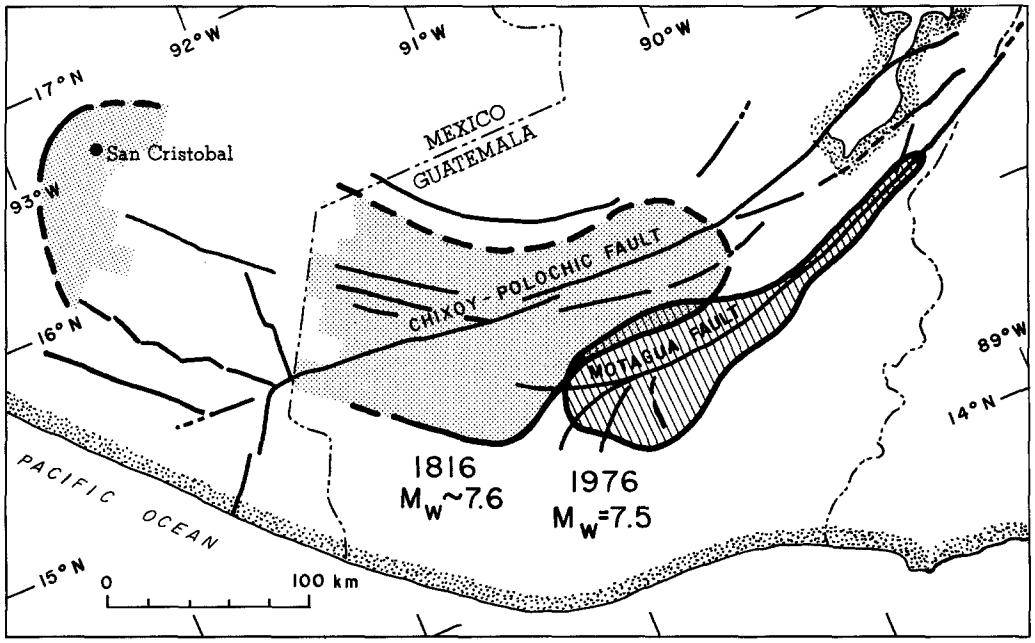

FIG. 4. Areas of intensity VII or greater in 1816 and in 1976. *Stippling* indicates the area for which church damage reports were found for the 1816 earthquake and indicate intensity VII or greater. *Hachures* at *lower right* indicate the area of Modified Mercalli intensity VII or greater for the 1976 Guatemala earthquake $M_w = 7.5$.

therefore poorly constrained, it can be seen in Figure 4 that the area of damage in 1816 appears to be at least twice that determined for the 1976 earthquake (Espinosa *et al.*, 1976). Because seismic moment scales approximately with the square of the area of damage (Hanks *et al.*, 1975; Evernden *et al.*, 1981), and a moment of 2.6×10^{27} dyne-cm was determined for the 1976 earthquake (Dewey and Julian, 1976; Kanamori and Stewart, 1978), a moment can be estimated for the 1816 earthquake at 1×10^{28} dyne-cm. However, the length of fault available for rupture is apparently less than 300 km, so, unless slip was anomalously great, this moment estimate would seem to be too large.

An alternate approach to estimating the moment, and one that may be considerably more accurate, is to note that for the special case of shallow strike-slip faults, the maximum extent or length of the known damage of intensity VII, L_{vii}, scales with the moment. Figure 5 is a plot of log L_{vii} against M_w (and corresponding log

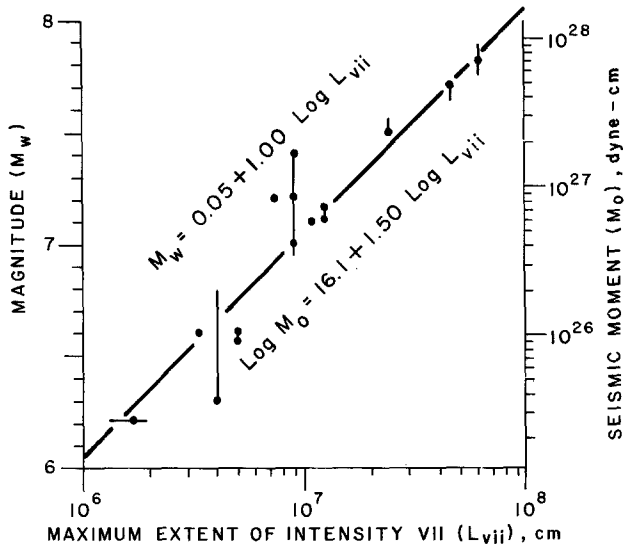

FIG. 5. Length of intensity VII versus magnitude. Maximum extent or length of modified Mercalli intensity VII damage, L_{vii}, versus moment magnitude, M_w (and the corresponding seismic moment). *Ordinate values* are from moment or moment magnitude estimates when they exist, otherwise from surface wave magnitude (see Table 3). Equations shown are least-squares regression of M_w and M_0 onto L_{vii}.

M_0) for several strike-slip events from California, Turkey, Iran, and Central America. These data are listed in Table 3. Regressions of M_w and corresponding M_0 onto L_{vii} give the following least-squares fits for L_{vii} given in centimeters

$$M_w = 0.05 + 1.00 \log L_{vii} \text{ and } \log M_0 = 16.10 + 1.50 \log L_{vii}.$$

For all but the second Ghaenat earthquake, these equations estimate the magnitude to within 0.1 units and the moment to within a factor of about 1.3. This is not surprising. For strike-slip faults, L_{vii} is proportional to the rupture length L, the rupture width W is approximately constant for events larger than magnitude 6, and Scholz (1982; his Figure 8) shows that M_0 is proportional to L^2W. If we assume that the length of the zone of known damage for the 1816 earthquake of about 340 km is not much less than the length of the zone of actual damage, we can make use of the above relations. An L_{vii} of 340 km corresponds to a moment of 3.5×10^{27} dyne-

cm and a magnitude (M_w) of 7.6. From these arguments, I therefore estimate the moment of the 1816 earthquake to have been between 3×10^{27} and 8×10^{27}, and the corresponding magnitude to have been between $7\frac{1}{2}$ and $7\frac{3}{4}$. And assuming a rigidity u of 3.5×10^{11} dyne/cm^2 and a fault area A = 340 km × 15 km, we can estimate the expected displacement D, from $M_0 = uAD$, at 2 to 4.5 m.

Foreshock-Main Shock-Aftershock Sequence

A foreshock was reportedly felt at midnight local time (0600 GMT) on 22 July 1816, like an "an explosion" in Guatemala City (about 85 km south of the Chixoy-Polochic fault) and it "alarmed the community." A magnitude $M = 5$ to 6 earthquake near the center of the fault could have been responsible.

The main shock followed at 0930 local time (1530 GMT) on 22 July 1816. No estimates of the duration have been found.

TABLE 3

Strike-Slip Earthquakes for Which Lvii Could Be Determined

Date	Location	Magnitude	M_0 (× 10^{26} dyne-cm)	Lvii (km)
23 Dec. 1972	Managua, Nicaragua	M_S 6.2		14–20 (5)
14 Nov. 1979	Ghaenat(a), Iran	M_w 6.6 (1)	1.0 (1)	34 (6)
15 Oct. 1979	Imperial Valley, California	M_w 6.3, M_S 6.8	0.2–0.3	40 (7)
9 Apr. 1968	Borrego Mountain, California	M_w 6.6	0.6 (2)	50 (2)
2 July 1967	Mudurnu, Turkey	M_w 7.0	3.6–8.8, 15 (3)	91 (8)
27 Nov. 1979	Ghaenat(b), Iran	M_w 7.2 (1)	8 (1)	75 (3)
28 Mar. 1970	Gediz, Turkey	M_S 7.1		110 (9)
31 Aug. 1968	Dasht-e Bayaz, Iran	M_w 7.1	6.7 (4)	126 (10)
4 Feb. 1976	Guatemala	M_w 7.5	26	220 (11)
9 Jan. 1857	Ft. Tejon, California	M_w 7.7	53–87	460 (12)
18 Apr. 1906	San Francisco, California	M_w 7.8	35–43	630 (13)

Data sources: M_w and M_0, from Sykes and Quittmeyer (1981, Table 1), except as noted; M_S, from Seismological Notes, *Bull. Seism. Soc. Am.*; (1), Niazi and Kanamori, (1981); (2), Hanks *et al.* (1975); (3), Stewart and Kanamori (1982); (4), Hanks and Wyss (1972); (5), Hansen and Chavez (1973); (6), Haghipour and Amidi (1980); (7), Nason (1982); (8), Ambraseys and Zatopek (1969); (9), Tasdemiroglu (1971); (10), Ambraseys and Tchalenko (1969); (11), Espinosa *et al.* (1976); (12), Agnew and Sieh (1978); (13), Lawson *et al.* (1908); Map 18 (estimated from Rossi-Forel VIII).

The reported aftershocks are compatible with a shallow focus earthquake of very large magnitude. Aftershocks were felt in Guatemala City "for a few days afterwards" and were still being felt in San Cristobal las Casas after 10 days. A minimum magnitude of 4+ seems reasonable for these events. In the Soloma area where damage from the main shock seems to have been worst, a report made on 22 September, 2 months after the main shock, states that residents were "worried by the continuation of the many earthquakes, 45 to 50 per day ranging from small to large." For events on the Chixoy-Polochic fault to be felt in the Soloma area, I estimate a minimum of magnitude 3.0.

Finally, on 30 January 1817, a strong aftershock further damaged the cathedral at San Cristobal las Casas, in Chiapas, Mexico. This event was not reported in Guatemala, which might suggest that a magnitude 5+ event on a secondary fault between San Cristobal las Casas and the Guatemala border may have been responsible.

CONCLUSIONS

The Chixoy-Polochic fault region of Guatemala has been considered to be of low seismic risk by many planners simply because no destructive earthquakes were previously known for this region. It can now be said that the Chixoy-Polochic fault is currently an active part of the Caribbean-North American plate boundary capable of producing very large earthquakes. The earthquake of 22 July 1816 apparently ruptured at least the central portion and probably the western portion of the Chixoy-Polochic fault, and may have ruptured nearby NW-trending reverse faults to the northwest. From the damage, a moment is estimated at between 3×10^{27} and 8×10^{27} dyne-cm and corresponds to a magnitude (M_w) between $7\frac{1}{2}$ and $7\frac{3}{4}$. The extensive aftershock sequence is compatible with a shallow earthquake of this magnitude range. These data for the 1816 earthquake should prove useful for estimating the damage that may be expected from future large earthquakes on the Chixoy-Polochic fault.

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REFERENCES

Agnew, D. C. and K. E. Sieh (1978). A documentary study of the felt effects of the great California earthquake of 1857, *Bull. Seism. Soc. Am.* **68,** 1717–1929.

Ambraseys, N. N. and J. S. Tchalenko (1969). The Dasht-e Bayaz (Iran) earthquakes of August 31, 1968, a field report, *Bull. Seism. Soc. Am.* **59,** 1751–1780.

Ambraseys, N. N. and A. Zatopek (1969). The Mudurnu Valley, west Anatolia, Turkey, Earthquake of 22 July 1967, *Bull. Seism. Soc. Am.* **59,** 521–577.

Anderson, T. H., B. Burkart, R. E. Clemans, O. H. Bohnenberger, and D. N. Blount (1973). Geology of the western Altos Cuchumatanes, north-western Guatemala, *Geol. Soc. Am. Bull.* **84,** 804–826.

Burkart, B. (1978). Offset across the Polochic fault of Guatemala and Chiapas, Mexico, *Geology* **6,** 328–332.

Diaz, V. M. (1930). *Conmociones Terrestres en la America Central,* Guatemala, 268 pp.

Dewey, J. W. and B. R. Julian (1976). Main event source parameters from teleseismic data, *U.S. Geol. Surv. Profess. Paper 1002,* 19–23.

Erdlac, J. E. Jr., and T. H. Anderson (1982). The Chixoy-Polochic fault and associated features in western Guatemala, *Geol. Soc. Am. Bull.* **93,** 57–67.

Espinosa, A. F. (Editor) (1976). The Guatemalan earthquakes of February 4, 1976, a preliminary report, *U.S. Geol. Surv. Profess. Paper 1002,* 90 pp.

Evernden, J. F., W. M. Kohler, and G. D. Chow (1981). Seismic intensities of earthquakes of the coterminus United States—Their prediction and interpretation, *U.S. Geol. Surv. Profess. Paper 1223,* 56 pp.

Haghipour, A. and M. Amidi (1980). The November 14 to December 25, 1979 Ghaenat earthquakes of northeast Iran and their tectonic implications, *Bull. Seism. Soc. Am.* **70,** 1751–1757.

Hanks, T. C. and M. Wyss (1972). The use of body-wave spectra in the determination of seismic source parameters, *Bull. Seism. Soc. Am.* **62,** 561–589.

Hanks, T. C., J. A. Hileman, and W. Thatcher (1975). Seismic moments of the larger earthquakes of the southern California region, *Geol. Soc. Am. Bull.* **86,** 1131–1139.

Hansen, A. F. and V. M. Chavez (1973). Isoseismal maps of the Managua December 23, 1972 earthquake, *EERI Conference Proceedings on the Managua, Nicaragua Earthquake*, Vol. 1, 104–115.

Harlow, D. H. (1976). The Guatemala earthquake of February 4, 1976, a preliminary report, instrumentally recorded seismic activity prior to the main event, *U.S. Geol. Surv. Profess. Paper 1002*, 12–15.

HIDROCHULAC (1982a). *Boletin Sismico*, ano 1, vol. 1, Guatemala, 24 pp.

HIDROCHULAC (1982b). *Boletin Sismico*, ano 1, vol. 2, Guatemala, 19 pp.

INSIVUMEH (1979). *Boletin Sismologico, Ano 1978*, ano 2, Guatemala, 72 pp.

INSIVUMEH (1980). *Boletin Sismologico, Ano 1979*, ano 3, Guatemala, 109 pp.

INSIVUMEH (1981). *Boletin Sismologico, Ano 1980*, ano 4, Guatemala, 87 pp.

Kanamori, H. and G. S. Stewart (1978). Seismological aspects of the Guatemala earthquake of February 4, 1976, *J. Geophys. Res.* **83,** 3427–3434.

Kupfer, D. H. and J. Godoy (1967). Strike-slip faulting in Guatemala (abstract), *Trans. Am. Geophys. Union* **48,** 215.

Lawson, A. C., G. K. Gilbert, H. F. Reid, J. C. Bonner and A. O. Lenschner, G. Davidson, C. Burckhalter, and W. W. Campbell (1908). Atlas, State Earthquake Investigation Commission Upon the California Earthquakes of April 18, 1906, *Carnegie Institution of Washington, Publ. 87*, 451 pp.

Lopez-Ramos, E. (1975). Carta Geologica del Estado de Chiapas (2nd ed.), Instituto de Geologia, Universidad Nacional Autonoma de Mexico, 1:500,000.

McBirney, A. R. (1963). Geology of a part of the central Guatemala Cordillera, *Univ. Calif. Publ. Geol. Sci.* **38,** 177–242.

Montessus de Ballore, F. (1888). Tremblements de Terre et eruptions volcaniques an Centre Amerique, *Société des Sciences Naturelles de Saone-et-Loire*, Dijon, Paris, France, 293 pp.

Muehlberger, W. R. and A. W. Ritchie (1975). Caribbean-Americas plate boundary in Guatemala and southern Mexico as seen on Skylab IV orbital photography, *Geology* **3,** 232–235.

Nason, R. (1982). Seismic intensity studies in the Imperial Valley, *U.S. Geol. Surv. Profess. Paper 1254*, 259–264.

Niazi, M. and H. Kanamori (1981). Source parameters of 1978 Tabas and 1979 Qainat, Iran, earthquakes from long-period surface waves, *Bull. Seism. Soc. Am.* **71,** 1201–1213.

Richter, C. F. (1958). *Elementary Seismology*, W. H. Freeman, San Francisco, California, 768 pp.

Sapper, C. (1925). Los Volcanes de la America Central, *Estudias sobre America y Espana, extra-serie 1*, verlag, Von Max Niemeyer, Haale, 120 pp.

Scholz, C. H. (1982). Scaling laws for large earthquakes: consequences for physical models, *Bull. Seism. Soc. Am.* **72,** 1–14.

Schwartz, D. P., L. S. Cluff, and T. W. Donnelly (1979). Quaternary faulting along the Caribbean North-American plate boundary in Central America, *Tectonophysics* **52,** 431–445.

Stewart, G. S. and H. Kanamori (1982). Complexity of rupture in large strike-slip earthquakes in Turkey, *Phys. Earth Planet. Letters* **28,** 70–84.

Sykes, L. R. and R. C. Quittmeyer (1981). Repeat times of great earthquakes along simple plate boundaries, in *Third Maurice Ewing Symposium on Earthquake Prediction 4*, D. W. Simpson and P. G. Richards, Editors, AGU, Washington, D.C., 217–247.

Tasdemiroglu, M. (1971). The 1970 Gediz earthquakes in western Anatolia, Turkey, *Bull. Seism. Soc. Am.* **61,** 1507–1527.

Vassaux, J. P. (1969). *Cincuenta Anos de Sismologia en Guatemala Observatorio Nacional*, Observatorio Nacional, Guatemala, 98 pp.

White, R. A. and D. H. Harlow (1978). Preliminary catalog of aftershocks of the Guatemala Earthquake of February 4, 1976, *U.S. Geol. Surv., Open-File Rept. 79-864*, 69 pp.

Woodward-Clyde Consultants (1979). *Microearthquake Investigation for the Chulac and Xalala Hydroelectric Projects*, 49 pp.

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APPENDIX

The first document is the only document from the archives of the cathedral at San Cristobal las Casas, in Chiapas, Mexico. The other manuscripts, excerpts, and abstracts in this Appendix are derived from documents found at the Archivo General de Centro America (AGCA) located in Guatemala City, Guatemala, or at the Archive General de Indias (AGI) located in Seville, Spain. Manuscripts at the AGCA are cited by Signatura-Legajo-Expediente: Signatura designates the section of the archive, Legajo designates the particular bundle of manuscripts, and the Expediente designates the individual manuscript within the bundle. When the manuscript has page numbers, they are given in parentheses. For the second manuscript cited in this Appendix, A1.21.8-388-8085(1) indicates section A1.21.8 of the archive, bundle 388, manuscript 8085, page 1. Manuscripts at the AGI are cited by Ramo name and Legajo number. "Guatemala 487" indicates the Guatemala section of the archive, bundle number 497. Note that at the AGI, the bundles do not have their manuscripts numbered individually.

Other archives were checked but the records did not provide useful data; they are all located in Spain: Hacienda de Sevilla, Biblioteca Universiteria (Seville); Biblioteca de Circulo de Amistad (Cordoba); Biblioteca Publica Provincial de Cordoba; Biblioteca Publica de Granada; Biblioteca General de Universitario (Granada); Archivo de la Real Chancellaria (Granada); Archivo Historico Nacional (Madrid); Archivo General de Simancas (Valladolid); and the Archivo del Servicio Historico Militar (Madrid).

The following manuscripts, excerpts, and abstracts are headed by one line of notes that show the number that I have assigned the document for ease of reference in the text, the town where the document originated, the archive where it currently resides, its reference or "call" number as described above, and the date the document was written. Where multiple call numbers are given for a single entry, this indicates that several manuscripts containing essentially redundant information were found. Where the original document has been quoted, the text is given in quotes. Where the text given here has been abstracted from the original, or where parenthetical information has been added, this information has been enclosed in brackets. Occasional Spanish words whose original meaning is not well conserved in the English translation are given in parentheses.

(1) *Ciudad Real, Chiapas*; archive: *S. C.*; call# *S.C., VI.A.2*; date: *1817*

"The tremor that was suffered in this city on the 21st and 22nd of July of this year has damaged notably the roofs, bell tower, and one of the arches of this, our sacred church. Jose Domingo Arrayo, the only architect in the art of masonry in this city, went down underneath the broken roofs and the old middle tower with me. We examined curiously the interior of the surviving arches and terraces of the main building. Jose said the mixture on the exterior surface of the roofs of the two lateral naves has dissolved from the heavy rains of the month of the earthquake. It caused the same roofs on the outside to crack in many places, in such a way that they cannot be repaired soon. In a short time it will perforate the wood beams and ruin the terraces. The principle arch (arco toral) of the main chapel threatens ruin not because it supports too much weight but because the keystone is splitting due to the walls separating on both sides. To repair it, it is necessary to assemble scaffolding and install steel reinforcements as soon as possible. If the tremors

continue as it is feared, it will be a fatal disaster and difficult to remedy. Beyond what has been said it is evident that the tremor opened a crack from the top to the near window, but it doesn't seem to need repair right away. The bell tower of the same cathedral fell to the plaza for the most part. However, it had been demonstrated that it was not built properly to begin with. It didn't have reinforcing walls. What remains threatens imminent ruin, especially if the tremors continue with the frequency that has been experienced, causing fear for the other important buildings and houses in the area."

(2) *Totonicapan*; archive: *AGCA*; call# *A1.11.25-6118-56670*; date: *Aug. 3, 1816*

"... from the President, Governor, and Captain General of the Royal Audiencia of Guatemala to the Governor of Totonicapan and Huehuetenango ..."

"... left imprisoned in the office of His Majesty on the 27th of July by the earthquakes that began the night of the 21st; they have caused considerable damage in this capital and in all of the province, several churches having fallen according to the notices from the parish priests."

"... because of having received the report of the governor of Totonicapan and Huehuetenango concerning that which occurred July 22 and caused grave damage in the various towns."

"God keep Your Majesty many years,
Totonicapan, August 3, 1816. Jose de Bustamente"

[President of the Audiencia of Guatemala]

(3) *Totonicapan*; archive: *AGCA*; call# *A1.21.8-388-8085(1)*; date: *Aug. 21, 1816*

Hearing at Totonicapan, 1816.

Consultation with the mayor of the province (alcalde maior) concerning the ruin of various towns of his province and in particular those of the parish of Soloma, by the earthquake of the 22 of July of this year.

I hope that the ajoining report serves to inform the Tribunal of the Royal Audiencia and that you advise me of its reception.

God keep His Majesty many years.
Totonicapan, August 21, 1816.

Francisco Pacheco y Beteta
Mr. Fernando Palomo
Auditors General of Real Properties

(4) *Totonicapan*; archive: *AGI*; call# *Guatemala 497*; date: *Aug. 21, 1816*

"Our acting mayor of Totonicapan [Province], moved by the pitiful state in which the Indians of this district find themselves due to the destruction caused by the earthquake of 22nd of last July, begs Your Excellency to show your usual mercy and grant a postponement of the payment of their tributes.

In the parish of Soloma there was not a church, convent, or house that has not fallen to the ground and thus the wretched Indians wander around with absolutely no place to shelter their unfortunate families. The following is hardly worth mentioning but these natives have no way to feed themselves. The grain they had harvested was buried beneath the barns which collapsed during the earthquake and the grain fields were buried by the earth which opened up and swallowed them. Another mayor is quite certain of this since, having received so much information, he has decided to send the necessary supplies to help them. Not only in the parish

of Soloma was there destruction, but also in those [parishes] of Jacaltenango, Chiantla, Huehuetanango, Malacatan, San Cristobal [Totonicapan], Momostenango, and in this district capital [San Miguel Totonicapan] and although it [the earthquake] did not cause the same [amount of] damage in the latter towns, it did knock down the churches, convent, and houses.

In such a grievous situation as these unfortunate Indians find themselves they have begged me to represent them in asking Your Excellency for a token of your kindness in granting them a respite in paying their taxes, and Your Excellency should not hesitate to agree to the request of the unfortunate Indians.

God keep Your Excellency many years.

Totonicapan, August 21, 1816."

(5) *Guatemala City*; archive *AGCI*; call# *A1.21.8-388-8085(4, 5)*; date: *Aug. 26, 1816*

"Francisco Pacheco y Beteta

Royal Court, August 26, 1816

In answer to the acting mayor of Totonicapan [Province], relevant information regarding the damage caused by the earthquake of the 22nd of last July to the church, convent, and houses of the towns in the parish of Soloma was obtained, and it forms the basis from which provisions for emergency restorations needed by each building are being made. In agreement with the parish priest, this is the aid on which you can count: supplies needed by each town, providing they have been punctual in paying their taxes each year, and everything else they may need in accordance with the Seventh Article of the Royal Ordinance of Mayors, together with the fairness of the court despite the postponement in the contribution of these taxes, in view of the information which an inspector may find.

Fernando Paloma

The preceding royal decree was sent to the Mayor of Totonicapan in an official note dated September 3, 1816."

[This last line appears to have been added shortly after the document was written.]

(6) *Guatemala City*; archive: *AGI*; call# *Guatemala 496*; date: *Oct. 3, 1816*

"October 3, 1816. On the night of July 21 of this year, around 12:00 midnight, an explosion was felt in this capital [Guatemala City] that was so strong it alarmed the community; however, it was only a precursor to another much stronger and longer in duration which occurred at 9:30 in the morning the following day, the 22nd.

Although it did not cause any noticeable damage, it is acknowledged that some buildings were weakened since some cracks were observed in them that did not previously exist. The local citizens predicted that it should have caused some damage although the direction of its origin was not determined, the opinions on this point being quite diverse.

During the following few days the movements of the earth continued, though lightly and with less explosiveness; phenomena called "retumbos," audible rumblings, occurred frequently and news began to arrive of damage done in the towns of Totonicapan and Quetzaltenango, to the cathedral in Ciudad Real [today called San Cristobal las Casas], and to other towns of these regions where most of the houses and public buildings fell to the ground. The same thing is known to have occurred in the entire province of Verapaz located to the north of this capital

[Guatemala City], and obliged me to issue several warnings about cleanliness and other precautions based on the dispatches that I have received, and because another greater calamity was feared to be imminent in these towns.

But if the above-mentioned towns think themselves unfortunate, the town of Soloma and its annexes have suffered frightening and continuous earthquakes since the cited day of July 22, and if they should be reported to be without damage by the inspection made by the parish priest and the mayor of the district, it appears that the shaking was incomparably greater than that which ruined Antigua Guatemala in the year 1776. Six towns lost a total of nine churches, six parochial houses, six Indian council rooms, and 378 houses; 23 individuals perished and 57 hills split or broke open from the force of the explosion, making a tremendous mess of the roads and rivers in that area.

After receiving a decree which gave me authority to exercise any legal action necessary I gave the order that aid should be given personally to those unfortunate residents who are enduring daily hardships, especially those lacking sustenance. The above-cited inspection is based on a visual examination made and reported to me last September 22nd, worried by the continuation of the many earthquakes, 45 to 50 per day ranging from small to large.

The same mayor believes that the many rocks thrown out by the eruption of the hills are peculiar, and is convinced that such events can produce a wealth from the mineral kingdom. This reminded me of our recent experience of the eruption of Isalco volcano [El Salvador] where at its base was found a prodigious quantity of ammonia salts which supplied this kingdom and that of New Spain quite abundantly for some years. This caused me to conceive the idea that two trained people should explore the ruins of Soloma. I communicated this to the honorary chief commissioner Mr. Prudencio Cozar, who has many local acquaintances. He told me that this occurred near the Unirias Station [location unknown], and that up to December [the salts] will be abundant. As the earthquakes had not stopped, it was necessary to allow some months to pass.

I am relating this to Your Excellency for your information and I agree to report the results of the exploration when it is carried out, and whatever else considered worthy of your attention.

3 October 1816
Jose de Bustamante"
[President of the Audiencia of Guatemala]

(7) *Chiantla*; archive: *AGCA*; call# *A1.11-6118-56730*; date: *1818*

"I, Mr. Jose Seferino Aguilar, head priest of the Parish of the Benevolence of Chiantla says that since the year of 1816 in which there occurred the ruin from the earthquakes that ruined the four churches of my parish which are: the one of this chief town of Chiantla, Aguacatan, todos los Santos Cuchumatanes, and San Martin Cuchumatan; and I have come to see with great pain the indecent state in which these towns were left by divine wisdom.

Our Lady of the Candelaria of Chiantla"
[Complete document contains 10 pages.]

(8) *Chiantla*; archive: *AGCA*; call# *A1.11.25-2806-24685*; date: *1821*

"The chief priest of the parish of Chiantla duly declares to Your Excellency the

necessity that he has to replace the churches of his annexes: Todos Santos Cuchumatan, and San Martin that were ruined by the earthquakes four years ago. . . ."

"Our Lady of the Benevolence of Chiantla"

(9) *Chiantla*; archive: *AGCA*; call# *A1-2801-42358*; date: *1816*

"The principals of the town of Chiantla ask to be pardoned from their tribute corresponding to the semesters of 1816 by reason of the earthquakes that occurred the 22nd of July 1816."

(10) *Aguacatan y Chalchitan*; archive: *AGCA*; call# *A1.11-6119-56865*; date: *1816*

"We, the justices and principals of the town of Aguacatan y Chalchitan, say that the church and priests' quarters (casa parroquial) of our town were completely ruined by the earthquakes of the 22nd of July and those that followed.

We ask that Your Highness concede to our communities the sum decided upon by the surveyors for this work."

[Complete document contains 14 pages.]

(11) *Todos Santos Cuchumatan*; archive: *AGCA*; call# *A1.11-6118-56688*; date: *1817*

"To the Governor of the Province of Totonicapan and Huehuetenango. We, the community, mayors, and principals of the town of Todos Santos Cuchumatan, say that in the past year of 1816 on the 25th day of June our church was disgraced by earthquakes . . . the main chapel was knocked to the ground, the vestry, the bells, all fell to the ground . . ."

[Complete document contains 2 pages.]

(12) *Huehuetenango*; archive: *AGCA*; call# *A1.11-6118-56663*; date: *1816*

"The funds that exist for the reconstruction of the churches of the towns of the parish of Huehuetenango, damaged by the earthquakes of July 21, 1816." [The towns of the parish of Huehuetenango were San Lorenzo, San Sebastian, Santa Isabel, San Juan, Santiago, San Pedro, and Santo Domingo and Huehuetenango.]

(13) *Huehuetenango*; archive: *AGCA*; call# *A1.11.25-388-8094*; date: *1817*

"The community of the town of Huehuetenango solicits the fund to rebuild the church, ruined by the earthquakes of July 22, 1816."

[Complete document contains 34 pages.]

(14) *Malacatan*; publication: *Monografia del Huehuetenango*; date: *1954*

"The church at Malacatan was ruined"

[Today this town is called Malacatancito.]

(15a–e) *Totonicapan*; archive: *AGCA*; call# *A1.11.25-388-8084*; date: *1816*
A1.11.25-388-8085; date: *1816*
A1.11.25-388-8086; date: *1816*
A1.73-6118-57607; date: *1817*
A3.1-1344-225312; date: *1817*

[Over the appropriation of 2500 pesos for the restoration of the church of San Miguel Totonicapan, today known simply as Totonicapan] "ruined by the earthquakes of July 22, 1816."

(16) *Totonicapan*; archive: *AGCA*; call# *A3.253-5191*; date: *1818*
"The community of San Miguel Totonicapan solicits exoneration from the payment of tributes owed, because of the ruin caused by the earthquakes of July 22, 1816."

(17a–c) *San Cristobal Totonicapan*; archive: *AGCA*;

call# *A1.11.25-6118-5662*; date: *1816*
A1.11.25-6118-5667; date: *1816*
A1.11.25-6118-5692; date: *1817*

[Documents relating to the soliciting of funds to repair the church of San Cristobal Totonicapan, damaged by the earthquakes of July 21 and July 22, 1816.]

(18) *San Andres Xecul*; archive: *AGCA*; call# *A1.1-6118-56660*; date: *1816*
"The community of the town of San Andreas Xecul asks for the allotment of the funds of her communities to rebuild the church damaged by the earthquakes that occurred on July 22nd."

(19) *Santiago Momostenango*; archive: *AGCA*; call# *A1.11-25-2929-27459*; date: *1816*
"The church was ruined by the earthquakes of July 20, 1816."

(20) *Santiago Momostenango*; archive: *AGCA*;

call# *A1.11.25-6118-56675*; date: *1816*
A1.11-25-6118-57767; date: *1816*

[asking that the tributes paid to the king be diverted back to the town to finance the rebuilding of the church damaged by the earthquakes of July 22, 1816]

(21) *Quezaltenango*; archive: *AGI*; call# *Guatemala 498*; date: Mar. *1818*
"the report by the president on this date March 18, 1818 . . ."
"the extraordinary earthquakes which occurred in the town of Soloma in the province of Totonicapan to the west . . . as reported in my letter of October 3, 1816. The same earthquake was felt in Quetzaltenango forty leagues [95 km] away. Although it did not cause major damage [in Quetzaltenango] it did cause many families to flee the area in desperation and fear, looking for other places to live."

(22) *Santa Catalina Utatlan*; archive: *AGCA*; call# *A3.1-1344-22525(5)*; date: *1817*
"Over the necessity to rebuild the church of the town of Santa Catalina Utatlan [today called Nahuala] in Solola, and according to the evaluation the cost has been calculated for a mason and carpenter of 700 pesos. . . . They decide favorably to authorize funds destined for the reconstruction . . ."

(23) *Santa Catarina Ixtahuacan*; archive: *AGCA*; call# *A1.11.25-393-8202*; date: *1817*
"The past July the earthquake of the day of Santa Maria Magdelena completely ruined the church."

(24) *Santa Lucia Utatlan*; archive: *AGCA*; call# *A1.11-25-393-8194*: date: *1816*
[relating to the reconstruction of the church] "ruined completely on Jun 2 [July 22?] 1816."

(25) *San Antonio Ilotenango*; archive: *AGCA*; call# *A3-254-5230*; date: *1821*
"The mayor of the town of San Antonio Ilotenango solicits exoneration from the payment of tributes by reason of the damage caused by the recent earthquakes."

(26) *San Andres Sacabaja*; archive: *AGCA*; call# *A1.11-25-392-8192*; date: *Jul. 1816*
"The earthquake of the 21st day of the current month, in the night, and of the following day at 8 o'clock in the morning ... the church was ruined ... need to rebuild it from the floor up."

(27) *Joyabaj*; archive: *AGCA*; call# *A1.11.25-393-8193*; date: *1816*
A3.1-1344-22525(6); date: *1817*
"The head priest of the town of Santa Maria Joyabaj deduces that the ceiling of church of this town was ruined by the earthquake that occurred the 22nd of July of the past year (1816) and also because of termite damage; requests the authorization of the funds of the communities of San Miguel Joyabaj, of the jurisdiction of Alcaldia of Solola, those funds necessary to reconstruct the church of the said town ruined by the earthquakes of ... 1816."

(28) *Joyabaj*; archive: *AGCA*; call# *A3.1-1344-22525(6)*; date: *1817*;
[Tax relief petition from the town fathers of the town of Santa Maria Joyabaj.]

(29) *San Cristobal Verapaz*; archive: *AGCA*; call# *A1.11.25-384-7982*; date *1818*
"Father Francisco Arriata, priest of San Cristobal Cajcoj declares it to be necessary to rebuild the church ... because of the earthquake of Santa Maria Magdelena [which is the day of July 22] 1816, knocked down half of the dome (simborrio), more or less, of the church of Santa Cruz de Santa Elena (being four leagues from Coban) being sister churches within the parish of San Cristobal Cajcoj, ... for that aid which they solicit for its reconstruction."
[Complete document contains 20 pages.]

(30) *Salama*; archive: *AGCA*; call# *A1.11.25-383-7975*; date: *1816*
[Report to the Mayor of Verapaz province]
"The earthquake of the July 22 of this year [1816] destroyed the major part of the facade of this church, especially where the bells hang, leaving the site totally demolished and, because of the dangerous state, I ordered that they be brought down."
"... need to build a new bell tower ..."
[Complete document contains 66 pages.]

(31) *Salama*; archive: *AGCA*; call# *A3.1-1344-22525(11)*; date: *1817*
"Over the necessity to rebuild the royal office (town hall) of Salama, its bad state is alleged, and its replacement is urgent because of the danger that it poses."

(32) *San Miguel Chicaj*; archive: *AGCA*; call# *A1.11.25-384-7984(5)*; date: *1820*
"The natives of San Miguel Chicaj in the jurisdiction of Verapaz solicit that they be conceded the funds produced by their community the past year of 1818 to make various repairs needed by their church and to defray the cost for the ornaments and altars that were needed."
[This town is between Salama and Rabinal in Baja Verapaz Department]
[Complete document contains 12 pages.]