



Geothermal Study of the Ixtlán Fault in the Area of El Salitre, Mich.

José Martínez Reyes ^{*1}, Ignacio Moreno Nava¹, Iván Vera Romero¹, Osbaldo Ordaz Murillo¹, Agustina Ortiz Soriano¹, Francisco Javier Lira Mendoza².

¹University of La Ciénega of Michoacán de Ocampostate,
Av. Universidad 3000, Sahuayo, Michoacán, Mex.

²Geomatics Department, Federal Electricity Commission,
México City.

ABSTRACT

The Ciénega de Chapala zone is located to the east of the Cítala rift, which hosts a geological system that gives rise to regional hydrothermal activity, mainly the Ixtlán and Pajacuaran faults. Regional geothermal manifestation consist of superficial hydrothermalism made up of springs and hot water wells with temperatures between 48 and 94 C in Ixtlán de Los Hervores and San Juan Cósala, as well as mud volcanoes in Los Negritos. The waters and gases of these hydrothermal manifestations have physical-chemical characteristics that indicate the presence of geothermal fluids.

In the present work, the Ixtlán fault is studied locally in the town of El Salitre, Michoacán. The hydrothermal manifestations on the surface of the geothermal zone have a pH of 4 with a characteristic sulfurous odor and an emanation temperature between 40 to 92 C. For this reason, direct or indirect use can be given to the aforementioned geothermal resource.

KEYWORDS: GEOTHERMAL STUDY, EL SALITRE, MICHOACÁN

Received 11 Jan., 2022; Revised 25 Jan., 2023; Accepted 27 Jan., 2023 © The author(s) 2023.

Published with open access at www.questjournals.org

I. INTRODUCTION

The Michoacán area of la Ciénega de Chapala area is located to the east of the Cítala rift that gives rise to the graben and Chapala Lake. The graben is delimited by a pair of faults that allow geothermal activity in the region: the Pajacuaran and Ixtlán faults. (Gómez Tuena et al, 2005).

STUDY AREA

Regional geology

The Ixtlán fault is part of the northern flank of the Chapala graben with a length of 30 km in a NW-SE alignment along the Duero riverbed, the fault is visible by a series of superficial hydrothermal manifestations (Rosas et al, 1989; Viggiano and Gutiérrez, 2007), while the Pajacuaran fault is part of the southern edge of the graben with a length of 20 km in an E-W orientation (Rosas and Olguín, 1981; Viggiano and Gutiérrez, 2007). The stratigraphy of the area consists mainly of andesites and basalts from the late Tertiary (Upper Miocene) to the Quaternary (Upper Pleistocene) that outcrop to the south of the region interspersed with lacustrine sediments, mainly Pliocene limonites and dolomites, which outcrop in the center. west and north of the area (Rosas et al, 1989; Viggiano and Gutiérrez, 2007).

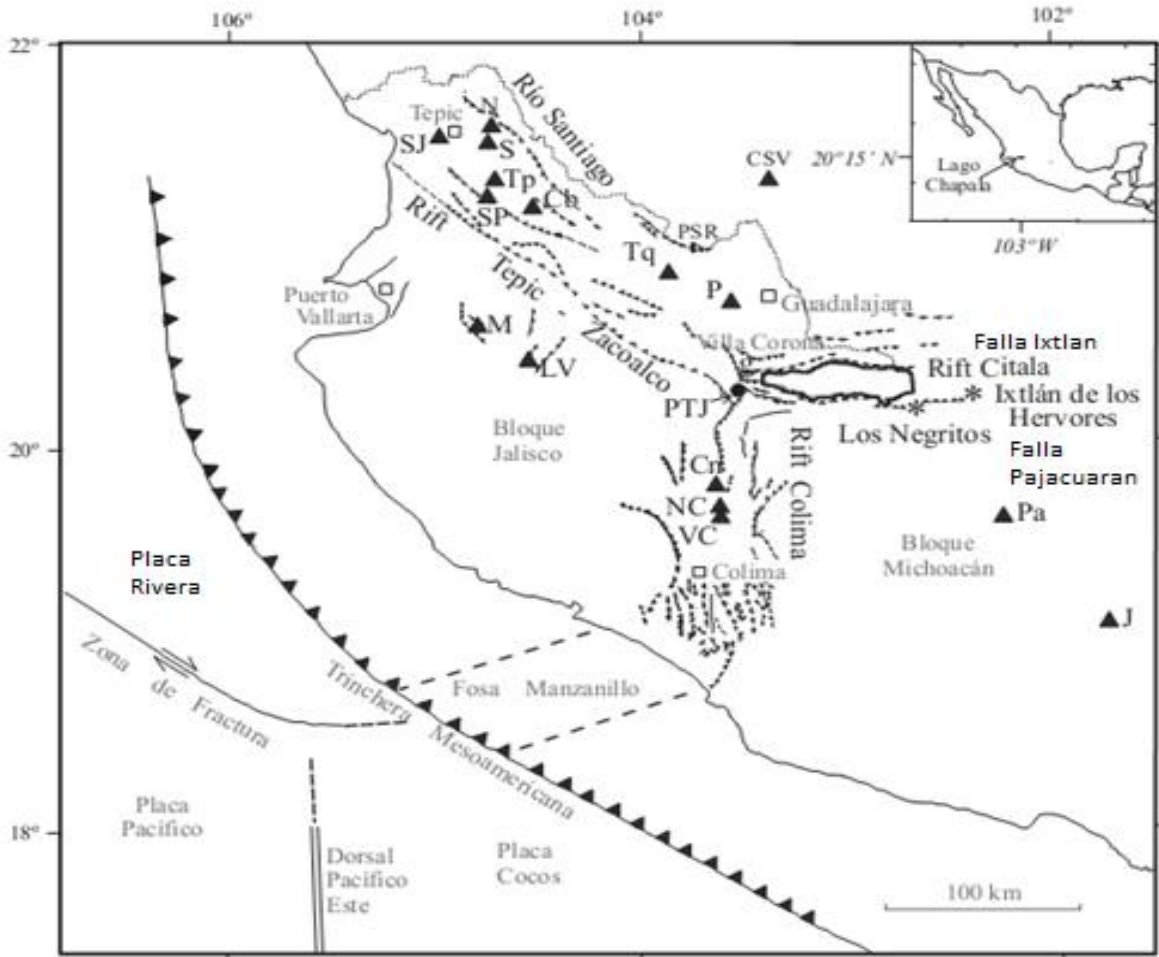
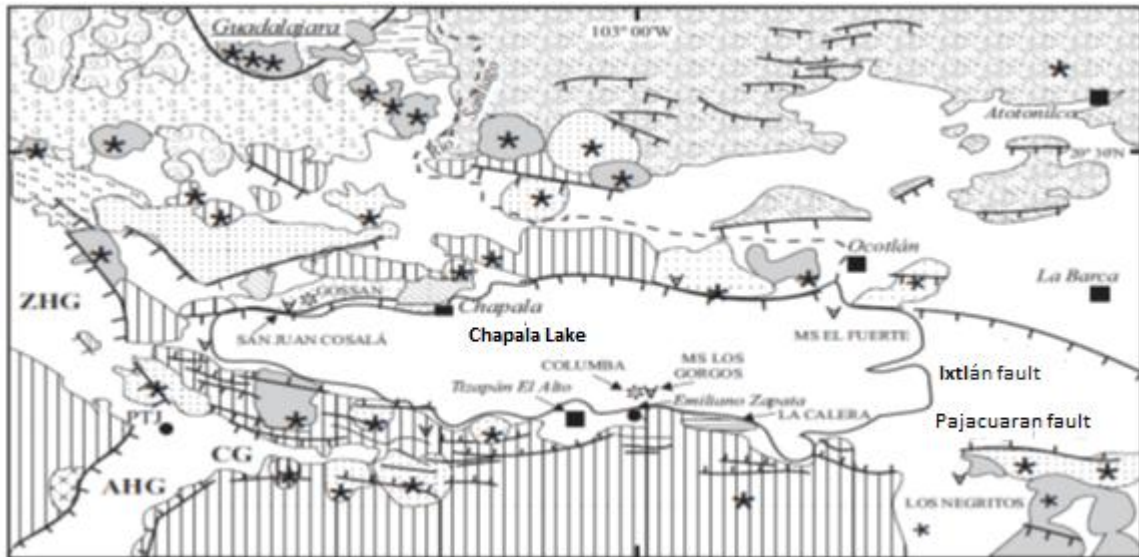


Figure 1: Regional Geology (Modified from Zarate and Simoneit, 2005)

Regional Geothermics

Regional geothermal manifestation consist of superficial hydrothermalism made up of springs and hot water wells with temperatures between 48 and 94 C in Ixtlán de los hervores (Quijano and Chacón, 1982; Tello, 1986a; Viggiano and Gutiérrez, 2007) as well as mud volcanoes in losnegritos (Villamar; Zarate and Simoneit, 2005). The waters of these hydrothermal manifestations are mainly of the sodium chloride type with a boron content that indicates the presence of geothermal fluids, in turn the gases from the same manifestations show a characteristic composition of geothermal gases. The geothermometers of both fluids result in medium temperature geothermal reservoirs (125 to 225 C) for the area (D'Amore and Panichi, 1980; Tello, 1986b; Viggiano and Gutiérrez, 2007). On the other hand, the isotopy of the waters show an enrichment in oxygen 18 (18O) typical of geothermal environments (Tello, 1986b; Viggiano and Gutiérrez, 2007).



*Monogenetic volcanoes V Geothermal manifestations
Figure 2: Geothermal manifestations of the Cienega de Chapala
(Modified from Zárte and Simoneit, 2005)

PRELIMINARY GEOTHERMAL STUDY OF THE IXTLÁN FAULT IN THE AREA OF EL SALITRE, MICHOACÁN

The data was collected in the community of El Salitre, which is a small town located on the Ixtlán fault, Google Maps (2022) locates it with the following coordinates:

Latitude: 20.164258N
Longitude: -102.373349 O



Figure 3: Data collection area taken from Google (2022)

Temperature data of the superficial hydrothermal manifestations were obtained: with values from 40 to 94 C (FLUKE Ti 32 IF FUSION THERMOGRAPH)

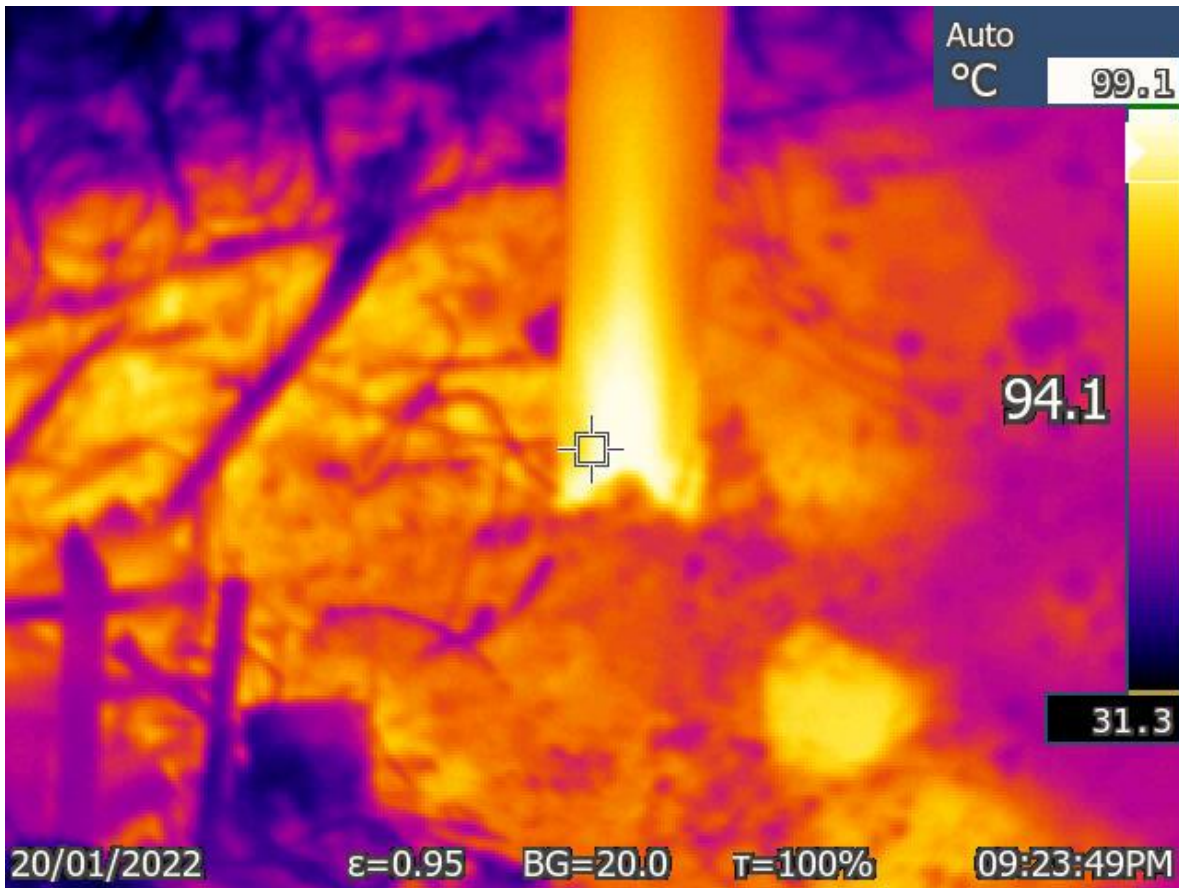


Figure No 4: Image of temperature lecture using theFLUKE Ti 32 IF FUSION thermograph as well as their pH using indicator paper, obtaining a value of 4.



Figure No 5: Image of pH reading of hot springs with pH indicator paper.

Georadar images of the Ixtlán fault (approximately 20 meters from South to North) were also obtained at the indicated coordinates.

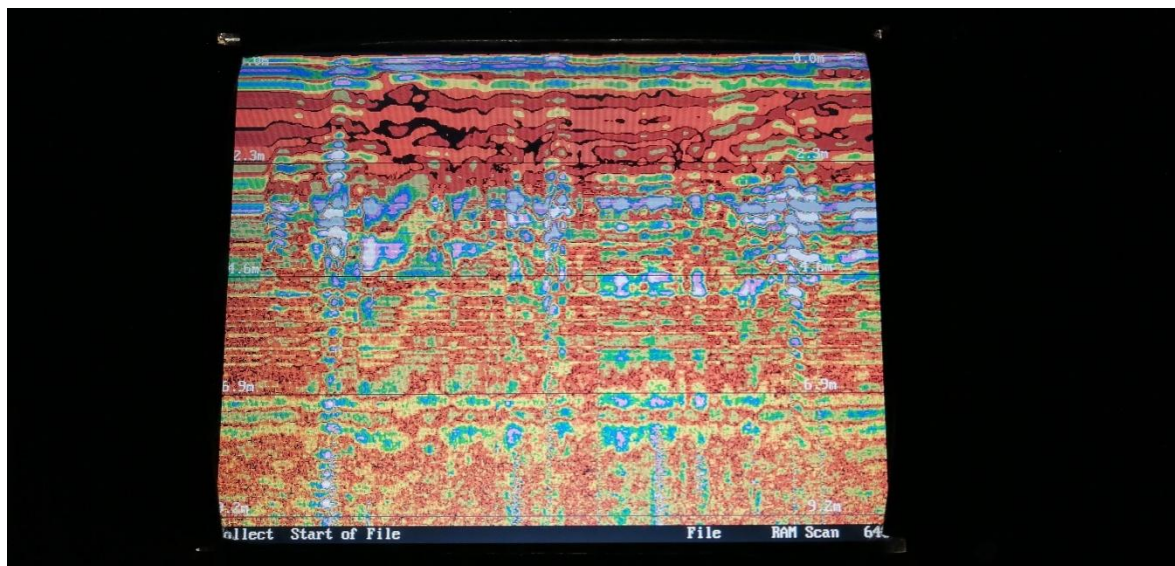


Figure No 6: Georadar image of the Ixtlán fault (GPR GSSI SIR2000 georadar).

The georadar equipment used is:

GPR GSSI SIR2000 with 200 MHz antenna

Dielectric variable: 4

All of the above characteristics together result in a possible wide-fracture geothermal reservoir (fault width greater than 100 m) of low relief with a maximum phreatic level of 3 m deep.

References

- [1]. D'Amore, F. y Panichi, C., 1980. Evaluation of deep temperatures of hydrothermal systems by a new gas geothermometer. *Geochimica et Cosmochimica Acta*, 44, 549-556.
- [2]. Google maps, 2022.
- [3]. Gómez Tuena, A.; Orozco-Esquivel, Ma. T. y Ferrari, L., 2005. Petrogénesis ígnea de la Faja Volcánica Transmexicana. *Boletín de la Sociedad Geológica Mexicana*, 52-3, 227-283
- [4]. Quijano, J.L. y Chacón, M., 1982. Evaluación geoquímica de las zonas geotérmicas de Ixtlán de los Hervores y Los Negritos, Mich., Informe técnico interno No. 59/82. Morelia, México: C.F.E., 28 pp.
- [5]. Rosas, J. y Olguín, A., 1981. Estudio Geológico de Ixtlán de los Hervores, Estado de Michoacán. Informe técnico interno, No. 38/81. Morelia, México:C.F.E., 43 p.
- [6]. Rosas, J.; Urrutia, J. y Maciel, R., 1989. Geología del Extremo oriental del graben de Chapala, breve discusión sobre su edad: zonas geotérmicas Ixtlán de los Hervores-Los Negritos, México. *Geotermia*, 5-1, 3-18.
- [7]. Tello, E., 1986a. Características químicas e isotópicas del agua de manantiales termales de las zonas geotérmicas de Ixtlán de Los Hervores y Los Negritos, Michoacán. *Geotermia*. 2-1, pp. 43-53.
- [8]. Tello, E., 1986b. Química de los gases de las zonas geotérmicas de Ixtlán de los Hervores y Los Negritos, Mich. Informe técnico interno No. 07/86. Morelia, México: C.F.E., 13 pp.
- [9]. Viggiano Guerra, J.C. y GutiérrezNegrín, L.C.A., 2007. Estudio Petrográfico y modelo conceptual Preliminar de la Zona geotérmica de Ixtlán de los Hervores, Michoacán, México. *IngenieríaHidráulica en México*, 22-4,61-73.
- [10]. Zarate del Valle, P.F. y Simoneit, B.R.T., 2005. La generación de Petróleo Hidrotermal en sedimentos del Lago de Chapala y su relación con la actividad geotérmica del rift Citla en el estado de Jalisco, México. *Revista Mexicana de Ciencias Geológicas*, 22-3, 358-370.