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Some of the Immediate Damages and Preliminary Observations on the 22 June, 2020 Champhai Earthquake, India

Malsawmtluanga*[1], P.C. Zoramthara[2], F. Zodinthara[3] and J.L. Pachuau[4]

[1]Department of Geology, Lunglei Govt College, Lunglei, Mizoram 796 701, India
[2]Department of Disaster Management, Aizawl, Govt of Mizoram 796 009, India
[3]Department of Geography, Govt JB College, Lunglei, Mizoram 796 701, India
[4]Department of Botany, Govt Champhai College, Champhai, Mizoram 796 321, India

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ABSTRACT

Earthquakes are amongst the worst geological hazards. There is no way to prevent earthquakes from happening. The devastating impacts of such event on the other hand can be greatly reduced by gaining a scientific grasp of their nature, origin, frequency, magnitude and understanding regional tectonics. In the Mizoram region of North East India, the majority of the plate motion in the Indo-Burmese Wedge is accommodated by dextral slip along the Churachandpur Mao Fault (CMF). Several great and major earthquakes had occurred in the past in North East India. The Vaphai earthquake which occurred at 04:10 am on 22 June, 2020 in Mizoram caused many immediate damages and destructions in Mizoram especially within Champhai district. At least 20 aftershocks were recorded the following months and this created widespread panic and fear amongst the local population. Many dwelling houses, community assets, schools, government buildings, livestock and properties were damaged.

Key words: *Damages, Earthquake, Observations, Champhai, Mizoram.*

Introduction

Earthquakes are global phenomenon and are caused by fault movements that have formed over time as a result of geological and tectonic processes. They are one of the most devastating of all the geological hazards because they strike enormous areas, resulting in massive death, injury with devastation of physical resources. They happen without warning and are hence unpredictable. The magnitude, location, and time of an earthquake determine how much damage it can inflict. The Vaphai earthquake (epicentre) was one such seismic event which occurred on 22 June, 2020 in Champhai district of Mizoram with a magnitude of 5.5M_w in the early hours of 04:10 am IST Fig. 1. Malsawma *et al*. (2021). Champhai district is located in the transboundary area of India and Myanmar and was the worst affected district for the earthquake.

Materials and Methods

Mizoram is a young sedimentary terrain with rocks from Oligocene to recent deposits are found throughout the state. Identification of buildings and structures, questionnaire design, geological

([1]Assistant Prof.,[2]Coordinator,[3]Assistant Prof., [4]Assistant Prof.)

fieldworks and data collection were done. Plate motion between the India and Sunda plates is accommodated by the north–south oriented Indo-Burmese arc, which links the Himalayan arc via the North East Himalayan syntaxial bend. The Sagaing Fault and the Indo-Burmese Wedge are responsible for the Indian plate primarily northward motion relative to the Sunda plate Gahalaut *et al*. (2013).

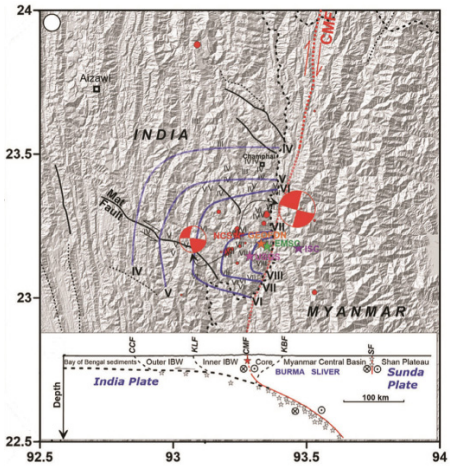

Fig. 1. Epicentre of the 22 June 2020 Vaphai earthquake

According to geodetic GPS data from the North East India region, the bulk of motion in the Indo-Burmese Wedge (IBW) is accommodated by dextral slip along the Churachandpur Mao Fault (CMF) albeit in a predominantly aseismic manner, at least in Manipur and south Nagaland regions which are located in the north from Champhai district, Mizoram. The normal motion of the remaining arc in the Indo-Burmese Wedge is accommodated on the plate boundary interface west of CMF, which is considered active seismically Steckler *et al.* (2016); Mallick *et al*. (2019). Most of the earthquakes from the Indo-Burmese Wedge occurs below the plate interface (depth >25 km) and are classified as intraslabKundu and Gahalaut (2013). These results and measurements are consistent with the focal mechanism solutions too. The Indo Burmese Wedge, the Myanmar Central Basin and the Sagaing Fault all together make up the India–Sunda plate boundary zone Fig 3, which is bounded to the west by the Bay of Bengal sediments and to the east by the Shan Plateau Fitch (1912); Dain *et al*. (1984) and Caffrey (1992). The Mat fault Tiwari *et al*. (2015) and the Chite fault Malsawmtluanga *et al*. (2019) are two prominent faults from Mizoram and they do not exhibit active seismicity in present day.

Results and Discussion

The National Centre for Seismology (NCS, Gov't of India) reported a shallow depth of 20km for the earthquake. This indicates that the Vaphai earthquake occurred within the wedge and was not an intraslab Indian plate earthquake type, which typically occurs at depths more than 30 km. From focal mechanisms, strike-slip motions were observed on the steep planes which supported either dextral or sinistral motions which resemble that of the Mat fault but was not and the event was not associated with any fault from Mizoram. However, the immediate damages caused by this seismic event was disastrous and in some places of the district, the maximum intensity of VIII of the Medvedev-Sponheuer-Karnik (MSK intensity of damage scale) was assigned in certain places. Villages from the Champhai RD Block and the Khawbung RD Block were the most affected regions from the seismic event within Champhai district. A total of 92 dwelling houses which are made of single and double storeyed buildings, mostly of Assam Type and RCC construc-

Fig. 1. Collapsed roof

Fig. 2. Damaged sewer and pipe fittings

Fig. 3. Damaged community hall

Fig. 4. Damaged place of worship

Fig. 5. Damaged residential house

Fig. 6. Surficial cracks in Vaphai

tions were immediately damaged. The nature of the damage include cracked walls, cracked pillars, collapsed roofs Fig. 1 and walls were common. Sewer and pipe fittings were broken in many areas (Fig. 2) including destruction of masonry structures. Community halls (Fig. 3), buildings and places of worship (Fig. 4) were not spared too, 23 of such community assets were damaged and were verified throughout Champhai district. 6 schools and 8 government institutions and a Police Outpost at Zokhawthar were damaged along with their office materials. Few livestock including piglets and pets were also lost due to this seismic event. Damaged roofs and houses were common especially in Vaphai village (Fig. 5). Cracks on the ground were observed in many villages (Fig. 6).

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