２０１７年１１月２４日

イラン・イラク地震情報（ペルシャ語⇒英語）

次ページ以降の資料は以下のイランの大学の先生のお力で「ペルシャ語⇒英語」化をして頂いたものです。地震の基本情報、歴史、被害概要などが記載されています。元の情報（ペルシャ語）については以下をご参照ください。

（ペルシャ語）http://www.iiees.ac.ir/fa/

何かあれば、Iman Mansouri 教授にコンタクト頂いて結構です。了解を得ております。

新日鐵住金株式会社
技術開発本部
菅野　良一

＝＝＝

Hi Dr. Kanno,

Finally I translated the IIEES report. Please find attached file. Certainly, because of time limitation there are several grammatical errors. Sorry in advance. I hope this helps.

Sincerely,
Iman

Iman Mansouri
Assistant Professor
Dept. of Civil Engineering
Birjand University of Technology
P.O. Box 97175-569, Birjand, Iran
E-mail: mansouri@birjandut.ac.ir
Alternate E-mail: im_pce@yahoo.com

＝＝＝

Figure 3. The focal mechanism of the Sarpolzahab earthquake on November 14, 2017 (adopted from www.emsc-csem.org)

2- Seismicity background of the region

Over the past 117 years, approximately 358 earthquakes have been recorded in the range of about 1 degree in 1 degree around the earthquake center (Figure 4), of which 21 earthquakes have a magnitude of greater than or equal to 5 (M• . This represents a relatively moderate seismicity of the region.

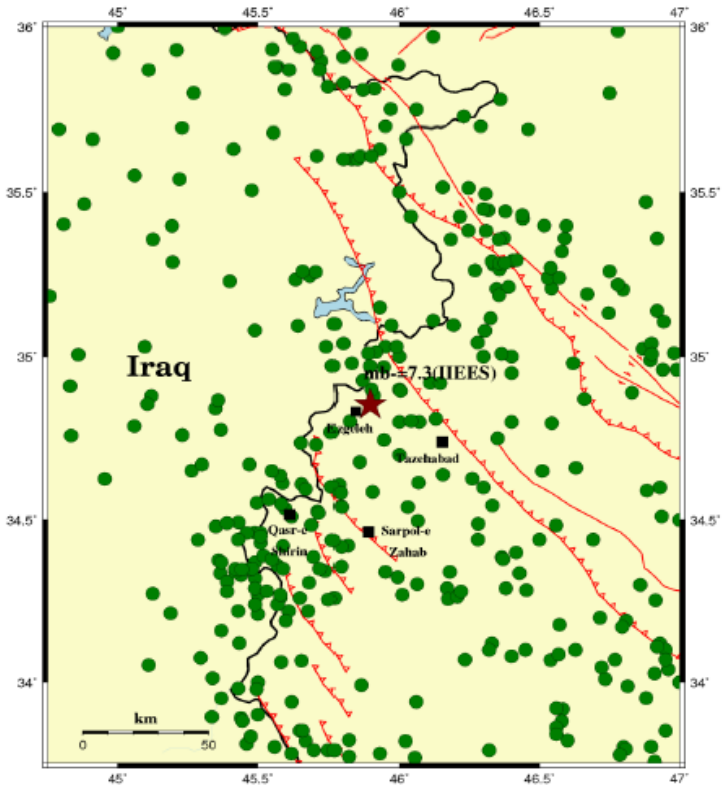

Figure 4. Seismicity of the recent 117 years of the earthquake focus (earthquake information taken from the Institute website)

3- General geology of Kermanshah province

According to different point of views, Iran can be divided into several main structural-sedimentary zones. Kermanshah is one of the western provinces in Iran having border with Iraq. The oil signs in the southern part of the province have caused the geology of the province being attractive to oil explorers.

From geomorphology point of view, the two northeast and southwest parts of the province do not have the same morphology. The northern heights have a rough face and their morphology is mainly resulted from the abundant thrust faults in the area while in other areas caused by the tectonic motion of folding type. Therefore, its morphology is as anticlines and synclines parallel with the northwest trend.

Geological data show that the most part of Kermanshah province is located in the Zagros sedimentary-structural basin, therefore, its northeastern corner has the geological features of the Sanandaj-Sirjan Zone. Thus, the province can be divided into two distinct sub-zones, which the boundary between them is characterized by the young and seismic Morvarid and Sahneh faults in (National Geosciences Database of Ian).

4- Historical earthquakes

- **Hulvan earthquake on Farvardin 12 – Ordibehesht 10, 337 SH (April 958 AD)**

In 347 AH, the earthquake Hulvan devastated the present Sarpolzahab, and killed many people in mountains. This earthquake, which was felt in Baghdad and its aftershocks continued throughout the first months of the year, affected the underground water resources in Zagros. The magnitude of the major earthquake was estimated by 6.4 on the surface-wave (Ms) scale (Ambraseys and Melville, 1982).

- **Hulvan earthquake on Farvardin 12, 529 SH (April 1, 1150 AD)**

A destructive earthquake was occurred in the Hulvan (Sarpolzahab) causing deformations of the earth in the mountains. Robat Behroozi was destroyed and a large number of Turkmen nomads were killed. The earthquake was severely felt in Baghdad, and the earth became as waves while shocking for several times, causing crack on some walls. The magnitude of this earthquake was estimated by 5.9 on the surface wave (Ms) scale (Ambraseys and Melville, 1982).

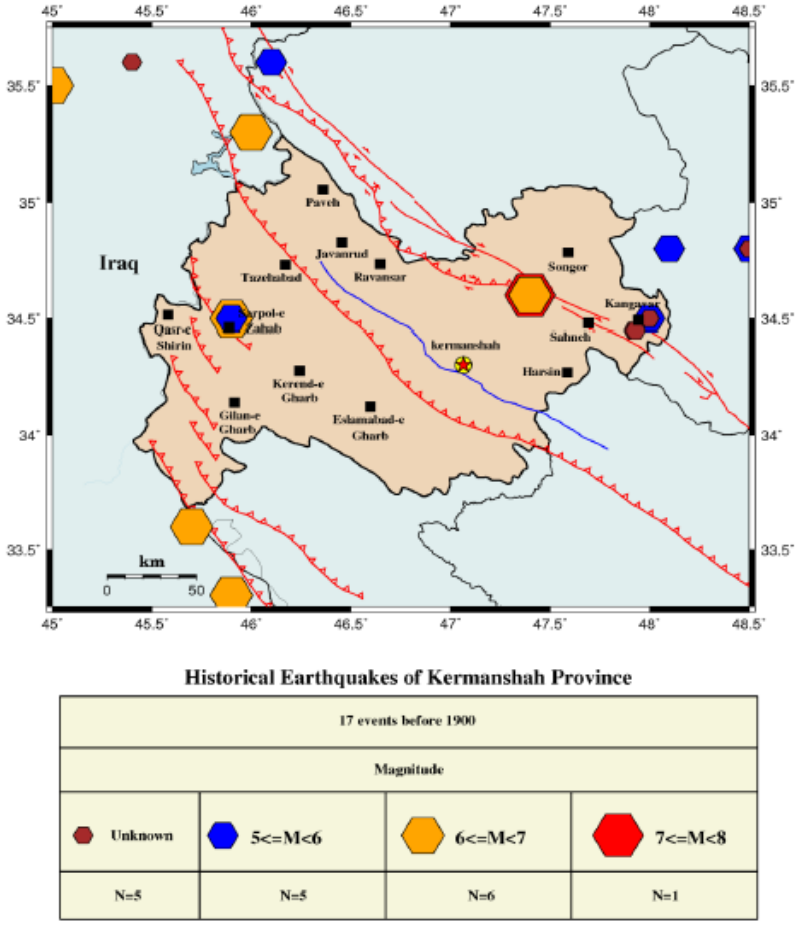

Figure 5. Distribution of historical earthquakes in Kermanshah province and its adjacent regions. Symbols including star: province center, black squares: cities and polygons: historical earthquakes.

5- Faults of the area

- **High Zagros Fault (HZF)**

This fault, with a length of 1375 km (Berberian, 1995) and a trend from northwest to south east, with a slope towards northeast, considered as a thrust type. This fault extends along the Zagros belt (Figure 2). Based on the present position of the Paleozoic rocks along this fault, its vertical displacement is estimated to be over 6 km (Berberian, 1981). Berberian (1994) attributed the following earthquakes to the high Zagros fault:

- The estimated M_S=6.4 and I_{MM}=VII Sharizur earthquake on Aban 27, 605 SH (Nov. 18, 1226 AD);
- The estimated M_W=5.3 and I_{MM}=VII Sharizur earthquake of 689 SH (1310 AD);
- The Ms=5.5 and I_{MM}=VII Marvdasht earthquake of 1002 SH (1623 AD);
- The estimated M_W=5.9 and I_{MM}=VII Daryan earthquake on Khordad 1244 SH (June 1865 AD);
- The M_W=5.8 and I_{MM}=VII Kharameh earthquake on Esfand 7, 1362 SH (February 26, 1984 AD);
- The M_S=5.7 Forg (Hormuzgan) earthquake on Aban 15, 1369 (November 6, 1990 AD);

High Zagros Fault (HZF) separates the Zagros Thrust Belt in the northeast from the Simply Folded Belt in the Southwest (Berberian, 1995). It is imagined that the lack of earthquakes in the high Zagros and the concentration of epicenters in the Zagros simply folded zone indicates that active deformation and seismicity have been transferred to the south from the high Zagros to the simply folded zone (Walker, 2006) (Sheikholeslami et al., 2013).

- **Zagros Mountain Front Fault (ZMFF)**

The Mountain Front Fault of the Zagros is composed of various fault segments of varying lengths from 15 to 115 km, with a total length of about 1,350 kilometers (in Iran) (Berberian, 1995). The general trend of this fault is NW-SE with a slope toward the northeast (Figure. 2). The mechanism of this fault is of (compressional) thrusting (Berberian, 1995). Geological evidence suggests that the vertical movement along this fault has been about 6 km (Berberian, 1995) so that the Cretaceous limestones have risen by about 6 km on the fault hanging wall, while the basement has been displaced less than 1.5 km (Oveisi et al., 2009).

The Zagros mountain front fault joins the high Zagros fault in the Khorgoo region. In fact, the high Zagros fault in this area is separated from the mountain front fault and extended along with the inverse Zagros fault. This fault, like the Zagros front fault, has been displaced right laterally by140-150 km due to the Kazerun Fault motion. The mountain front fault is parallel to the Zagros folded fault and high Zagros fault and are adjoined (together with them) to the lowest part of the crust and into the plastic shear zone (Berberian, 1995). The strike-slip and over-thrusting movement along the mountain front fault (MFF) is the main cause of the incision and change in the sinuosity of rivers such as Karoon, which have cut many bedrock sequences and folds. Deep fault fissure segments are together with asymmetric folds at the ground surface and given that the en echelon morphology and the absence of topographic and morphological features on the surface, the separated geometry of these fragments is resulted in depth (Berberian, 1995).

Segments of the mountain front fault are associated with a set of fault propagation folds such as Giskan anticline (Oeisi et al., 2009).

This fault has determined the southwestern boundary of the Zagros simply folded zone and the northeast boundary of the Zagros fore-deep basin. In other words, it forms the separation boundary of these two sedimentary zones form each other. The Zagros fore-deep basin is actually formed due to the mountain front fault (MFF) movement and over-thrusting of the Zagros simply folded zone. The Dezful embayment, which also considered as a separate zone, is bounded by the Dezful embayment faults (Lahbari) from the north, the Kazerun and Borazjan fault zones from the east and southeast, the mountain front fault from the northwest and the Zagros folded fault from the southwest (Berberian, 1995).

For example, the epicenter of the estimated M_S=6.8 earthquake of 431SH (1052 AD), the estimated M_S=5.8 earthquake of 464 SH (1058.05 AD), the estimated M_S=5.8 earthquake on Mehr 24, 1262 SH (October 16, 1883 AD), the M_B=6.3 earthquake on Tir 24, 1308 SH (July 15, 1929 AD), the M_B=5.8 earthquake on Dey 29, 1328 SH (January 19, 1950 AD), the M_S=6.2 earthquake on Azar 23, 1357 SH (December 14, 1978 AD), the M_B=5.5 and I_{MM}=VII northern Bandar Abbas earthquake on Dey 15, 1355 SH (January 5, 1977 AD), the M_W=6.7 Khorgoo, Bandar Abbas earthquake on Farvardin 2, 1356 SH (March 21, 1977 AD), the M_W=5.9 earthquake on Farvardin 10, 1367 SH (March 30, 1988) and the the M_S=5.6 earthquake on Aban 13, 1370 SH (November 4, 1991) can be attributed to the Zagros mountain front fault. The deep mechanism of these earthquakes mainly indicates a thrust with knotted plates parallel with geological structures and the mountain front fault (Berberian, 1995).

Berberian (1994) assigns the following earthquake events to the Zagros mountain front fault:

- The 11,000 years ago Seymareh earthquake, with the estimated M_W=7 and I_{MM}=IX caused Seymareh super-earthquake event;

- The estimated M_W=6.7 and I_{MM}=VIII Darreh Shahr earthquake on Tir 2, 251 SH (22 June 872 AD),
- The estimated M_W=6.3 and I_{MM}=VIII Sarpolzahab earthquake in spring 337 SH (958.04 AD);
- The estimated M_W=5.3 and I_{MM}=VII Siraf earthquake on Khordad 27, 357 SH (June 17, 978 AD);
- The estimated M_W=6.4 and I_{MM}=VIII Siraf earthquake in spring 387 SH (1008 AD);
- The estimated M_W=6.7 and I_{MM}=VIII Arjan earthquake in 431 SH (1052 AD);
- The estimated M_W=5.7 and I_{MM}=VII Arjan earthquake in 464 SH (1058.05 AD);
- The estimated M_W=5.8 and I_{MM}=VII Hulvan earthquake on Farvardin 12, 529 SH (April 1, 1150 AD);
- The estimated M_W=6.5 and I_{MM}=VIII Arbil earthquake on Ordibehesht 8, 558 SH (April 29, 1179 AD);
- The estimated M_W=6.8 and I_{MM}=IX Sharizur earthquake in about 952 SH (1573 AD);
- The estimated M_W=5.5 and I_{MM}=VII Magham earthquake in 1244 SH (1865 AD);

- The estimated M_W=5.7 and I_{MM}=VIII Kangan earthquake on Mehr 24, 1262 SH (October 16, 1883 AD) (Sheikholeslami et al., 2013).

6- Images of earthquake damages on November 12, 2017, Sarpol Zahab, Kermanshah


ISNA PHOTO
Pouria Pakizeh


@mariwan_rudaw
TOYOTA


اورزانس

7- References

Aghanabati, A., 2004. Geology of Iran, Geological Survey & Mineral Explorations of Iran (GSI).

Ambraseys, N. N., Melville, C. P. (1982). A history of Persian earthquakes. Cambridge University Press, UK. translation: Abolhasan Radeh, Agah Press, 1991.

International Institute for Earthquake Engineering and Seismology website, www.iiees.ac.ir

Eslami, A., Mahmoudi Kuhi, A., Javan Deloi, Gh., 2016. Seismicity and seismotectonic study in the Kermanshah province area and the importance of broadband seismograph stations, International Institute for Earthquake Engineering and Seismology.

New version of active faults in Iran, International Institute for Earthquake Engineering and Seismology.

Hessami Azar, Kh., Jamali, F., Tabasi, H,. 2003. Iran's active fault map, International Institute for Earthquake Engineering and Seismology.SH

Sheikholeslami, M. R., Javadi, H. J., Asadi Sarshar, M., Aghahoseini, A, Kuhpeyma, M., Vahdati, B., 2013. Encyclopedia of faults in Iran, Geological Survey & Mineral Explorations of Iran (GSI).