

ZHU Meng, LI Dewei, LIU Demin, LUO Wenxing and QIN Yadong, 2013. Classification of Magmatic Sulphide Deposits in China and Mineralization of Small Intrusions. *Acta Geologica Sinica* (English Edition), 87(supp.): 225-226.

Discovery and Its Tectonic Significance of Ancient earthquake in Pleistocene in Southwestern Margin of the Qaidam Basin

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Disastrous earthquake as one of the common geological events, is one of dynamic action forms within the earth, seismites rock is such material record of the event. In recent years, the study about seismites and ancient earthquake research has become a hot spot at home and abroad, but the existing finds concentrated in the Marine strata and old strata, rare seismites were found within the scope of the Qinghai-Tibet Plateau. Through the analysis of the field outcrop observation, we found a large number of lacustrine facies soft sedimentary deformation structures in the Pleistocene, southwestern margin of the Qaidam Basin, in the Zhongzaohe region of Golmud City, Qinghai Province.

The study area is located in the northeast margin of Qinghai-Tibet plateau, south to nearly east-west edge of basin-mountain, north to southern margin of the Qaidam Basin. Seismites events section developed in Pleistocene Qigequan lacustrine formation, which is covered by Holocene alluvial gravel and eolian sand, due to river erosion exposed.

1 Identification Marks

At present, the classification of seismites haven't uniform standard, scholars tend to keep ball-and-pillow structures, pseudonodules, folds, vibrational liquefaction deformation structure, seismic breccias, also step micro-faults together as identification marks of seismites at home and abroad. Integrated the existing classification method, this found is divided into soft sediment deformation structure and construction signs two parts. The former includes ball-and-pillow structures, pseudonodules, folds, vibrational liquefaction deformation structure, etc., while the latter contains step micro-faults, sagging-like structures and coseismic faults, etc.

2 the Distribution Law of Space and Time

According to analysis of seismites for ESR and OSL testing, the ancient earthquake activity is mainly focused on 1.8 ~ 1.2 Ma, 0.8 ~ 0.7 Ma and 0.7 ~ 0.14 Ma three stages: 1) three soft sediment deformation found in PM407 were unconformity covered by nearly horizontal occurrence strata in the upper part of the event layer, the test to event layer and unconformable surface shows that tectonic activity focused on 1.8 Ma, 0.8 Ma, 0.16 ~ 0.8 Ma. 2) Soft sedimentary deformation structures owing to tectonic activity in 1.8 Ma were found in PM407 at the bottom of the coseismic faults, And in view of the coseismic faults test show that they formed in 0.7 ~ 0.8 Ma. 3) PM408 section as a whole by the mainly gravel at the bottom of the river alluvial deposit gradually evolved into fine sand mud lake deposition, and soft sedimentary deformation structures. Tests show that this area occurred strong tectonic uplift in 1.8 ~ 1.2 Ma, under the influence of the orogeny it deposits a large amount of molasse, and in 0.8 ~ 0.4 Ma there were still very strong tectonic activities, and seismites were mainly concentrated in this period of time.

This results show that the discovered seismites can be divided into periods and the most strong or closest earthquakes occurred in 0.8 Ma, for all large coseismic fault and the unconformity between lake facies and fluvial gravel were formed in the stage. In the region, the tectonic events influence a wide range, such as the unconformity surface development in jiuquan conglomerate layer and yumen conglomerate in the hexi corridor formed in the 0.93~0.84Ma (Zhao Zhijun, 2001). Magnetic chronology study of the thick loess on the northern foot of western Kunlun confirm the loess formed at 0.88 Ma and the westerlies happened to flow around, these also indicate that the Tibetan plateau and its adjacent mountains has a sharp

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uplift in 0.88 Ma. For this uplift event of the Qinghai-Tibet Plateau in the late Early Pleistocene (Fang Xiaomin, 2001), some scholars believe that the extent of the impact is not only relates to the Tarim Basin, Qaidam Basin, Jiuxi basin, even farther than in the Loess plateau (Ge Xiaohong, 2004).

3 The relationship between seismic events and the plateau uplift

Qaidam Basin, northern Tibetan Plateau basin-mountain system important component unit, this series of seismites found in its internal related to the several pulsating overall uplift of Qinghai-Tibet Plateau in Late Cenozoic. Through the environmental evolution, geomorphic evolution, paleomagnetic, planation surface, paleosol around qinghai-tibet plateau since the quaternary research, Shi yafeng (1998, 1999) put forward the Tibetan plateau was created in periodic uplift since 3.6 Ma, and to subdivide it into 3.66 Ma (Tibetan g movement A), 2.58 ~ 2.14 Ma (Tibetan movement B), 1.8 ~ 1.23 Ma (Tibetan movement C), 0.93 ~ 0.84 Ma yellow movement (Kunhuang movement), 0.14 Ma (Gonghe movement). The seismites test results show that the forming age coincided with the terraces due to tectonic uplift of the Yellow River in the Lanzhou basin: T7 (1.6 Ma), T6 (1.5 Ma), T5 (1.2 Ma), T4 (0.8 Ma) and T3 (0.15 Ma). The Qinghai-Tibet plateau peripheral basin clastic sediments, glacier activities sites and ice core isotope test results showed similar results: including Qaidam basin, the north rim of the Qinghai-Tibet plateau have occurred strong tectonic activities many times since the Pleistocene.

As the sedimentary response to the overall uplift of the Qinghai-Tibet plateau, the seismites found in Qaidam basin

can be regarded as the evidence of uplift event in 1.8 Ma - 1.2 Ma, 0.8 Ma, 0.15 Ma (Li Dewei, 2008), and we infer that in the older strata there could be 3.6 Ma and 2.5 Ma two uplift tectonic activities of seismites exists.

4 The conclusion

Through research on the Quaternary seismites of the East Kunlun and south Qaidam, chronology testing and analysis process associated with the overall uplift of the Qinghai-Tibet Plateau, we get the following two conclusions: 1) As the latest ancient seismic strata in this region, this found is groundbreaking divided into soft sediment deformation structure and construction signs two parts. The former includes ball-and-pillow structures, pseudonodules, liquefaction sandstone and clay veins, folds, vibrational liquefaction deformation structure and seismic breccias, etc., while the latter contain Step micro-faults, sagging-like structures and syndimentary faults, etc. 2) The regional geological survey, the measured sections and sample tests analysis that there were three strong uplift of mountains in 1.8 Ma - 1.2 Ma, 0.8 Ma BP, 0.15 Ma BP, these uplift events are accompanied by a strong ancient seismic activity. As the sedimentary and structural response in the uplift event, it formed a series of typical continental facies intraplate seismites and the construction signs of seismites. It has a important significance to research the interpolate uneven uplift of the Tibetan Plateau and relationship among tectonic uplift, earthquake, deposition effects.

Key words: Seismite, Ancient earthquake, Pleistocene, Uplifting of the Tibetan Plateau, the Qaidam basin