ESR-Dating Investigations of Sediments by using Soil along the Southern part of Khong Marui Fault, Phang-Nga Province, Southern Thailand

Prawit Chansawa[1*] and Punya Charusiri[1]

[1]Department of Geology, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand
*E-mail: pinky_rainhotlove@hotmail.com

Abstract

The Electron Spin Resonance dating (ESR-dating) method has been applied on eight Quaternary samples from Ban Bang Leuk trench, southern Thailand. ESR intensity from *E′* defect center (g = 2.001) in extracted quartz molecule to be used for Equivalent dose(ED) by regeneration technique (Takashima and Honda, 1989) which irradiated 20 Gy , 40 Gy ,60 Gy ,90 Gy and 120 Gy. Annual dose (AD) ranges from 4.321 to 7.226 mGy/year. The calculation by ESR method is obtained from ED/AD. The estimated age of lowest and top sediment layer are 5150±410 year and 1575±300 year respectively.

Keywords: ESR-dating; Equivalent dose; Annual dose

1. Introduction

Khlong Marui Fault Zone is an interesting zone for studying the neotectonic activity especially in Changwat Phang-Nga. Some of them appear to be active because of many geomorphology evidences (**Fig. 1**) that can be related with fault -particularly offset stream and triangular facet and many earthquakes that have occurred. Geological age can indicate the event of fault movement by using the scientific dating method for Quaternary materials. Electron Spin Resonance (ESR) dating is the new method of dating and appropriate with young sediment. ESR was first successfully employed as a Quaternary dating technique by Ikeya (1975). It relies on the changes in electron orbits and spins caused by radioactivity over time. Ages are calculated by comparing the accumulated dose in the sample with the internal and external radiation dose rates produced by natural radiation in and around the sample. In general, the most important applicationlies in the time range between 40,000 and 200,000 years. ESR has many similarities as a dating technique to thermoluminescence (TL). It has some advantages over TL, primarily due to the fact that the signal is not destroyed during measurement, and so it is easier to study a given sample under a variety of experimental conditions. Ban Bang Leuk trench (**Fig. 2**), Phang-Nga Province is the study area. Electron Spin Resonance (ESR) dating method is used for dating by using sediments with regeneration technique (Takashima and Honda, 1989).The oxygen vacancies (*E′* centers) is measured for ESR intensity at room temperature. It is an important class of the defect centers in quartz. E' signal (g value = 2.001). This method can be used appropriately for dating quartz grains in sediment related to the age of fault movement. The fault dips to NE.

Fig.1 A set of NW-dipping triangular facet (yellow line) and trench (orange polygon) at Ban Bang Leuk, Amphoe Panom, Surat Thani. (Grid reference E98^{o} 42’ 14”, N8^{o} 39’ 54”) looking SE**.** This age will indicate whether this fault is active or not because active fault have to indicate that

the last movement was not more than 11,000 years ago (USGS, 1991) and represent the characteristics which they can be applied to make the active fault map for earthquake hazard protection planning.

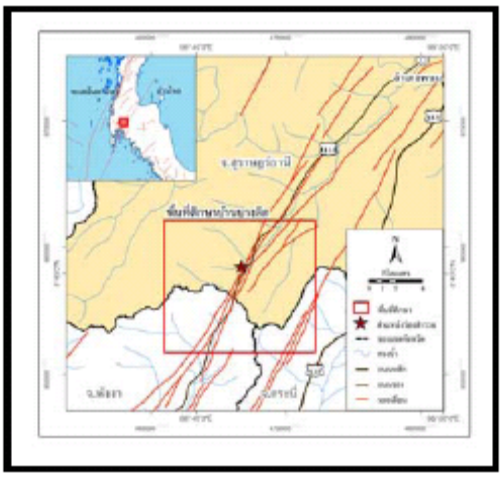

Fig.2 Study area (the red square) and trenching locality (the red star) in Ban Bang Leuk, Amphoe Panom, Changwat Surathani. Grid reference: E98° 41' 45", N8° 39' 52" (Geology Department, Faculty of Science, Chulalongkorn University, 2007).

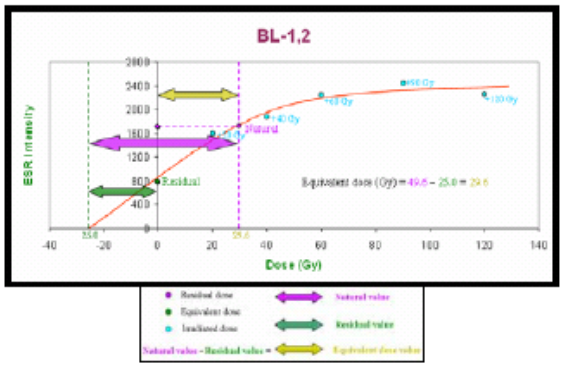

Fig.3 Example of BL-1, 2 growth curve which is obtained to Equivalent dose (ED**).**

2. Experimental Results and Discussion

After obtaining the Equivalent dose (ED) from regeneration technique and Annual dose , the ages of eight samples has been calculated in **Table 1** from ED/AD. The measured ESR ages mostly increase with the the depth of the sample. The age of lowest and top sediment layer are 5,188.27 year and 1,319.14 year respectively.

Table 1. The ages of the samples from ESR dating method**.**

Sample	Unit	Equivalent dose (Gy)	Annual dose (mGy/year)	ESR age (year)
BL-1,2	F	29.6	5.763	5,150 ± 410
BL-3	B	33.2	5.879	5,650 ± 500
BL-4,5,6	I	6.8	4.321	1,575 ± 300
BL-7	B	30.0	6.195	4,850 ± 475
BL-8,9*	C	23.2	6.333	3,660 ± 460
BL-10,11*	B	18.9	7.226	2,615 ± 320
BL-12,13	B	21.7	5.850	3,700 ± 505
BL-14,15,16*	I	11.0	5.531	2,000 ± 310

* Sample near by fault

3. Conclusion

The geomorphology evidences around the study area, in the offset gravel layers and relative age of sediment in Ban Bang Leuk trench show that the last movement of this fault occurred at about 2,000 year ago. The movement indicated is that of a left lateral oblique strike-slip fault. As the age is less than 11,000years, it might be concluded that this is an active fault.

Acknowledgement

Prawit Chansawa expresses sincere gratitude to Dr. Punya Charusiri Associate Professor for the advise and Dr. Sathorn Suwan, ESR Spectrometer officer for guidance assistance to during this research project.

References

Lee, H.K. and Yang, J.S., 2006. ESR dating of the Eupchon fault, South Korea, *Quaternary Geology*, **(2 - 1-4)**, 392-397.

Won-in, K., 2000. Neotectonic evidences along the Three Pagoda fault zone, Chanwat Kanchanaburi, M.Sc. Thesis, Department of Geology, Faculty of Science, Chulalongkorn University.

Yin Gongminga, Lin Min Lu, Yanchuna, Li Jianpinga, and Han Fei (2007). Preliminary ESR dating results on loess samples from the loess–paleosol sequence at Luochuan, Central Loess Plateau, China. Quaternary Geochronology **(2),** 381–385.