

INFORMATION ON DOCTORAL THESIS

1. Full name: Nguyen Huu Tuyen
2. Sex: Male
3. Date of birth: 25/11/1975
4. Place of birth: Ha Noi
5. Admission decision number: No 2259/SĐH December 07, 2006 by President of Vietnam National University, Hanoi.
6. Changes in academic process: An approval for extension study for 12 months from Rector of Natural Science University by the Decision No. 3345/QĐ-CTSV on December 17, 2009.
7. Official thesis title: Study of geo-dynamics condition for Tuan Giao and adjacent area, establish the scientific criteria for earthquakes prediction.
8. Major: Geotectonic
9. Code: 62 44 55 05.
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11. Summary of the new findings of the thesis

Specific results of the study have divided in 06 of the 2nd Geo-dynamic blocks: Hoang Lien Son, Song Da, Son La, Song Ma, Sop Cop and Dien Bien by the faults of the same rank. These 2nd Geo-dynamic blocks are continuously divided into the higher blocks system by integrated analysis of quantitative results of data set; topography, geomorphology, geophysics and the vertical movement, horizontal movement along these boundaries.

The significant vertical movement on the 2nd Geo-dynamic block are rather high by geomorphology indicator Vf such as; Tu Le Vf = 0.185, Phan Si Pan Vf = 0.199, Song Ma Vf = 0.248, Son La Vf = 0.282, Dien Bien Vf = 0.283, Sop Cop Vf = 0.365; and the remaining of 2nd Geo-dynamic blocks are relatively low (relative subsidence) of Song Da Vf = 0.484, Red River Vf = 0.938.

There is strong differentiation of an average vertical velocity for the Pliocene - Quaternary period (about 5 million years ago) between these 2nd Geo-dynamic blocks such as: The 2nd Geo-dynamic Hoang Lien Son is 0.5 - 0.9 mm/year (the highest speed of Phan Si Pan block > 0.7 mm/year, Tu Le block of 0.5-0.6 mm/year and Hung Khanh block of <0.5 mm/year); these 2nd Geo-dynamic of Son La, Song Ma, Sop Cop and Dien Bien are in range of average velocity at 0.3 - 0.5 mm/year; And these 2nd Geo-dynamic Song Da and Song Hong are rather low velocity with an average of 0.1 to 0.3 mm/year and <0.1 mm/year in respectively.

There are strong horizontal deformation along the 2nd Geo-dynamic block boundaries by calculated the geomorphology index of sinuosity (Smf) such as: Son La fault Smf = 1.5 to 2.1; Dong Tuan Giao fault Smf = 1, 3 to 2.0; Pu Ma fault Smf = 1.6 to 1.9; Muong Than - Khanh Yen fault Smf = 1.5 to 1.6. There are moderate of horizontal deformation along the 2nd Geo-dynamic block boundaries by geomorphology index of sinuosity (Smf) such as; Song Ma fault Smf = 2.1 to 2.3; Muong La - Bac Yen fault Smf = 2.1 to 2.5; Phong Tho fault Smf = 1, 7 to 2.3; Lai Chau - Dien Bien fault Smf = 1.6 to 2.7; Song Da fault Smf = 1.5 to 2.3. These other one are rather low of horizontal deformation along the 2nd Geo-dynamic block boundaries including Red River fault Smf = 2.3 to 2.7; Phan Sipan Smf = 2.2 to 2.7; West Tuan Giao Smf = 2.1 - 3, 0; Song Chay Smf = 3.2 to 3.5.

Research result of paleo-earthquake investigation has shown the possibility of maximum ancient earthquakes with magnitude greater than 7.5 (in Richter scale) had appeared in the study area. In the study area are able to predict the risk of nodes with threshold magnitude earthquake ≥ 4.0 and $M_o > 5.0$ by CORA application: The possibility of nodes with $M_o > 4.0$ including V9, V16, V25, v31, V38, V41, V42, V44, V48, V49, V57, V60, V61, V64, V66, V69; The possibility of nodes with $M_o \geq 5.0$ M_o including V1, V2, V6, V8, V9, V10, V11, V12, V13, V15, v23, V58, V61, V69, V70. The areas with the risk of strong earthquakes with magnitude $6.7 \div 6.8$ (the largest observed earthquake) distributed mainly along the 2nd Geo-dynamic boundary such as; Son La, Song Ma, Tuan Giao, Lai Chau - Dien Bien, Fumatun, Phong Tho - Mu Cang Chai, Than Uyen and Lao Cai-Sapa.

The thesis has selected an appropriate analytical methods and criteria of geology, geophysics, geomorphology, seismic for classification of geo-dynamics block, earthquake hazard and earthquake prediction of Tuan Giao and adjacent area. In addition, these results will provide the new research results and contribute additional research methodology for Geodynamics study, earthquakes prediction and geodynamic mapping.

12. Practical applicability, if any:

Based on the geodynamics research in order to establish a modern geodynamics map for Tuan Giao and adjacent area which service directly for earthquakes forecasting study and other geological hazards as sliding, erosion, subsidence assessment... These final result will provide the scientific glues for seismic zoning and earthquake predict of studied area. Moreover, through the implementation of the thesis will accomplish the methodology of geodynamic research in general and establish disciplinary for geodynamic mapping and earthquake prediction research for key areas. The results of these studies provide scientific criteria for policy and planning maker and relevant stake holder for sustainable development of Tuan Giao and adjacent area.

13. Further research directions, if any:

Applied research methods in mapping of modern geodynamics for the territory of Vietnam and for seismic hazard assessment of key zone for key economic region, an important construction sector (hydropower, nuclear power plant, security and defense works ...). Enhancing an methodology of seismic hazard and earthquake prediction based on utilizing the maximum data set of deep structure element, geodynamics, geomorphology, structure. Application in using the radioactive isotope of C14 to determine the age of the flattened surface of Tertiary and Quaternary epoch, define boreholes stress, identified radon anomalies to serve for quantitative study of modern tectonic movements.

14. Thesis-related publications:

1. Cao Dinh Trieu, Le Van Dung, Nguyen Huu Tuyen (2000), "Seismotectonic features of the Red River fault zone (RRFZ) in the main land of Vietnam", *Journal of Geology* 260(9-10), pp. 20-31.
2. Cao Dinh Trieu, Nguyen Huu Tuyen, Le Van Dung, Pham Nam Hung, Mai Xuan Bach (2001), Report Study of geological and Geotectonic and Neotectonic for Tuan Giao 1983 Earthquake epicentre region, Project Research of Vietnam Academy of Science & Technology, Hà Nội.
3. Cao Dinh Trieu, Le Van Dung, Nguyen Huu Tuyen, Pham Nam Hung, Mai Xuan Bach (2002), "Applied the precise gravity method in studying structures of SonLa hydro electric power dam", *Proceeding of The conference of Earthquakes and some natural disasters in Northwest region of Vietnam*, October 2002, Hanoi National University Publishing, pp. 45-65.
4. Cao Dinh Trieu, Le Van Dung, Pham Nam Hung, Nguyen Huu Tuyen, Thai Anh Tuan (2004), "Main structure units of the Earth's crust in Northwest region of Vietnam", *Journal of Sciences of the Earth* 26(3), pp. 244-257.
5. Cao Dinh Trieu, Le Van Dung, Pham Nam Hung, Nguyen Huu Tuyen (2005), "Geotectonic condition of Tuan Giao 1983 Earthquake epicenter region and adjacency" The report at 4th Vietnam Geophysical Conference, pp. 255-266.
6. Cao Dinh Trieu, Nguyen Huu Tuyen, Thai Anh Tuan (2006), "The correlation between Earth Crust structures and seismic activities of Northwestern Vietnam", *Journal of Sciences of the Earth* 28(2), pp. 155-164.
7. Cao Dinh Trieu, Ngo Thi Lu, Mai Xuan Bach, Nguyen Huu Tuyen, Pham Nam Hung, Thai Anh Tuan (2007), "Prediction of Maximum earthquake occurrence in Vietnam on the basis of crustal characteristics", The report at 5th Vietnam Geophysical Conference, Ho Chi Minh City, pp. 159-171.
8. Nguyen Huu Tuyen (2008), Report of Neotectonic condition of Sonla sesmogenic fault zone of Earthquake Ms=6.7, Project research of Institute of Geophysics, Vietnam Academy of Science & Technology, Institute of Geophysics, Hanoi.
9. Cao Dinh Trieu, Rogozhin E.A., Yunga S.L, Ngo Thi Lu, Nguyen Huu Tuyen, Le Van Dung, Nguyen Thanh Tung, Le Duy Bach, Vu Minh Tuan (2009), "Some initial results of the survey traces of suspicious activity by ancient earthquakes in the Northwest Region of Vietnam", *Journal of Geology* 311(3-4), pp.1-10.
10. Nguyen Huu Tuyen, Chu Van Ngoi, Cao Dinh Trieu, Ngo Gia Thang, Le Van Dung (2010), "Northwest structure and earthquake activities", *Collection Conference proceeding of University of Natural Sciences*, pp. 227-243.
11. Ngo Thi Lu, Belousov T.P., Kurtasov S.F , Ngo Gia Thang, Nguyen Huu Tuyen and etc (2010), "Research results in rock fractures, Paleostress state and the laws of geodynamics of crust northwest Vietnam", *Journal of science of the Earth* 32(3), pp. 271-279.
12. Nguyen Huu Tuyen, Cao Dinh Trieu (2010), "Characteristics of contemporaneous crustal deformation in thie Hoa Binh Hydroelectric Plant area based on analyzing the monitoring data during the period 2002-2008", *Journal of Geology* 316(1-2), pp. 24-35.

13. Ngo Thi Lu, Nguyen Huu Tuyen, Vu Thị Hoan, Tran Viet Phuong, Phung Thi Thu Hang (2010), "Detailed study of the most powerful earthquake in South East Asia". Collection report of VAST Vietnam, The 35th Anniversary Conference on Science & Technology, pp. 211-219.

14. Ngo Thi Lu, Le Van Dung, Nguyen Huu Tuyen (2010), "Seismicity on the Vietnamese territory and adjacent regions during period 1137-2008 ($M \geq 3.5$)", Journal of Geology B/(35-36), pp. 99-111.