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Tectonic Evolution of the Altun and Karakorum Mountains

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ABSTRACT

The Altun and Karakorum Mountains lie on the northwestern edge of Tibet. Because of their remote setting these regions were essentially unknown. Recently the author took part in the field investigations in the Altun Mountains and surrounding areas, such as Tarim and Qaidam Basins, and West Kunlun Mountains. Based on the practical data, this paper briefly deals with geological background of the Altun and Karakorum Mountains and discusses an intracontinental subduction or A-type subduction along southwestern margin of the Tarim Basin.

INTRODUCTION

The Altun and Karakorum Mountains lie on the northwestern edge of the Tibetan Plateau (Fig.1). Because of their remote setting, these regions were essentially unknown. Although geoscientists know little about the tectonics of the mountains, they are aware of their geological significance. For instance, Zhang (Tectonic Map Compiling Group,1974), Molnar and Tapponnier (1975), Molnar and Deng (1984), Zhang (1985), Pan (1990) discussed the formation and development of the region. From 1985 to 1989, the State Seismological Bureau of China organised a programme to survey the Altun Tagh Active Fault. The author had the opportunity for four times to take part in the field investigations along the Altun Mountains and surrounding areas, such as Tarim and Qaidam Basins and West Kunlun Mountains (Zheng 1991). The paper deals with the geological background of the Altun and Karakorum Mountains and the problem of intracontinental subduction or A-type subduction along the southwestern margin of the Tarim Basin.

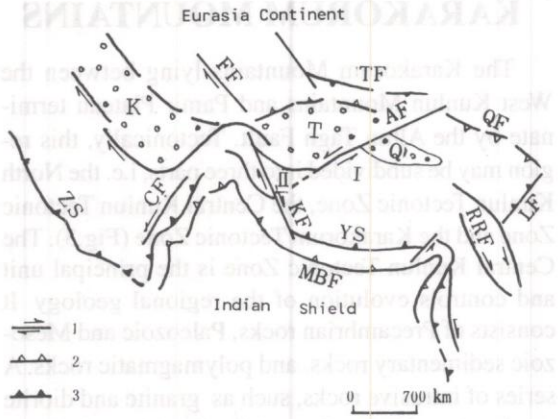

Fig. 1 Location of the Altun and Karakorum Mountains
1: strike-slip fault; 2: thrust fault; 3: collision zone; I: Altun Mountains; II: Karakorum Mountains; K: Karkum Basin; Q: Qaidam Basin; T: Tarim Basin; AF: Altun Tagh Fault; CF: Chaman Fault; FF: Fergana Fault; IS: Indus Suture; KF: Karakorum Fault; LF: Longmen Shan Fault; MBF: Main Boundary Fault; QF: Qilian Fault; RRF: Red River Fault; TF: Tien Shan Fault; YS: Yurlung Zangbo Suture; ZS: Zagros Suture.

ALTUN MOUNTAINS

The Altun Mountains are located in West China and extend from Xinjiang Autonomous Region to Gansu Province separating the Tarim and Qaidam Basins. They mainly consist of the Precambrian rocks. The oldest formation is Lapeiquan Granulite

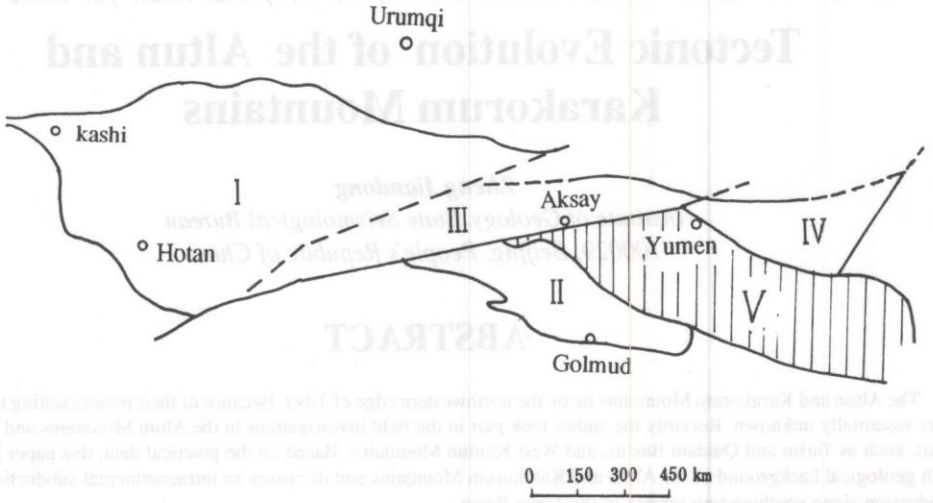

Fig. 2 Tectonic provinces of the Altun Mountains and surrounding areas
I: Tarim Basin; II: Qaidam Basin; III: Altun Fault Uplift; IV: Alxa Platform Uplift; V: Qilian Fold Belt

which mainly consists of pyroxene granulite and pyriclasite, belonging to the Upper Archean. The Proterozoic formations consist of Baxkorgan Group, Tashidaban Group, Xorkol Group, and Sinian System. The Baxkorgan Group and Tashidaban Group consist of such metamorphosed rocks as schist, marble, and belong to the Middle Proterozoic. The Xorkol Group and Sinian System are composed of non-metamorphosed clastic rocks belonging to the Upper Proterozoic. The Xorkol Group unconformably lies on the Tashidaban Group, by which was named the Altun Movement. The Paleozoic formations such as Ordovician and Carboniferous chiefly are exposed at the southern margin of the Altun Mountains. The Mesozoic and Cenozoic formations, which consist of terrestrial sediments are located in the intermontane and foredeeps. Thus, we suggested that the Altun Mountains constitute a stable block and have long been uplifted and do not belong to an orogenic belt. By comparing the basement of the Altun Mountains and Tarim and Qaidam Basins, we pointed out that the North-Western Platform is made up of four parts, i.e. the Tarim Depression, the Qaidam Depression, the Altun Faulting Uplift, and the Alxa Platform Uplift (Fig.2, Zheng1991). The Altun Mountains were quickly uplifted since the Late Cenozoic.

KARAKORUM MOUNTAINS

The Karakorum Mountains lying between the West Kunlun Mountains and Pamir Plateau terminate by the Altun Tagh Fault. Tectonically, this region may be subdivided into three parts, i.e. the North Kunlun Tectonic Zone, the Central Kunlun Tectonic Zone and the Karakorum Tectonic Zone (Fig.3). The Central Kunlun Tectonic Zone is the principal unit and controls evolution of the regional geology. It consists of Precambrian rocks, Paleozoic and Mesozoic sedimentary rocks, and polymagmatic rocks. A series of intrusive rocks, such as granite and diorite are developed in the Central Kunlun Tectonic Zone. The ages of which are 540 - 400 Ma and 260 - 200 Ma, and belong to the calc-alkaline series. Pan (1990) suggested that there are double arc-island structural zones in the Caledonian and Indosinian stages and the Mazar-Kongxiwar suture zone lies northwards. The North Kunlun Tectonic Zone also consists of Paleozoic and Mesozoic rocks, whereas the Precambrian rocks are limited and the igneous rocks are less than in the Central Kunlun. Therefore, it belongs to the passive continental margin in the Paleozoic and some parts of it are thrust over the Tarim Basin, where no obvious boundary is shown in between. The Karakorum Tectonic Zone lies south of the Central Kunlun Tectonic Zone and the southern boundary is

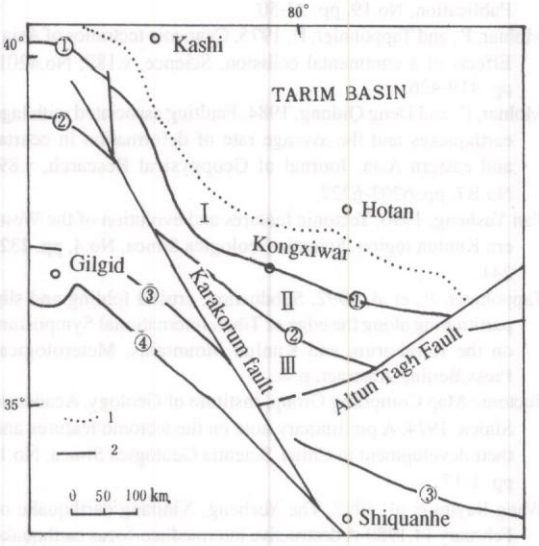

Fig. 3 Simplified tectonic map of the Karakorum and West Kunlun Mountains

I: North Kunlun Tectonic Zone; II: Central Kunlun Tectonic Zone; III: Karakorum Tectonic Zone; (1) Kongxiwar Fault; (2) Hongshanhu Fault; (3) Bangong Lake Fault; (4) Yarlung Zangbo River Fault.

the Karakorum Fault. It consists mainly of the Late Paleozoic and Mesozoic rocks, characterised by the Gondwana formations. The tectonic evolution of the Karakorum Tectonic Zone shows that the Gondwanaland reached there. It is necessary to point out the importance of the Altun Tagh Fault and Karakorum Fault, which are the principal structural lines in the northwestern edge of Tibet. The first fault is a left-lateral strike-slip fault, extending NEE about 1600 km. The second fault is a right-lateral strike-slip fault, extending NNW about 1000 km. These two faults create a huge escaping tectonics in North Tibet, by means of which neotectonics and seismicity of that region are controlled. Otherwise, we do not agree with the opinion of Tapponnier (1992) that the Altun Tagh Fault is curved in the Akayqin Lake and then linked with the West Kunlun Fault. We stated that the Altun Tagh Fault is a straight and left-lateral strike-slip fault zone, which does not mix up with other faults (Zheng 1993). Meanwhile, the Karakorum Fault does not link with the Fergana Fault. The former ends in the Pamir corner and the latter extends to the western margin of the Tarim Basin.

INTRACONTINENTAL SUBDUCTION ALONG SOUTHWESTERN MARGIN OF THE TARIM BASIN

Recently, some geoscientists, such as Yang (1984), Mattauer (1986), and Zheng (1992) described intracontinental subduction around the margin of Tibet. Deng (1992) suggested that the Tarim terrane subducted southwards to the Tibetan Plateau since Cenozoic. There are two evidences to show intracontinental subduction or A-type subduction along the southwestern margin of the Tarim Basin. (1) A Cenozoic volcanic zone lies in North Tibet, extending from West Kunlun to Hoh Xol about 1000 km. Its width is about 100 km in west and 400 km in east. According to lithochemical characteristics, the volcanic zone may be divided into two subzones, i.e. the Northern Subzone of calc-alkaline volcanic rocks and south subzone of alkaline volcanic rocks. The volcanic activity began at the Early Tertiary and became intensive in the Pleistocene. It is obvious that these tectonic associations of volcanos are responded to southward subduction from the Northern Tectonic Block. (2) An intermediate earthquake of Mb=6.0, occurred at the Yecheng County in the Tarim Basin on 14 February, 1980. It made the seismic intensity of VII in the surface. Wang et al. (1992) carefully studied the earthquake mechanism and seismotectonics of that seismic event (Fig. 4). They pointed out that there are two seismic zones along the southwestern margin of the Tarim Basin. One is an intermediate seismic zone which reaches 100 km in depth and the Yecheng earthquake would occur within it. The other is a shallow seismic zone located south of the intermediate seismic zone. Fig. 4 indicates that the Tarim Block subducts southwards by 25 -30 Km along the northern boundary fault of the West Kunlun Mountains, that microscopic epicentre of the Yecheng earthquake will be located at a depth of the intermediate seismic zone, and that the macroscopic epicentre will be located at the upper

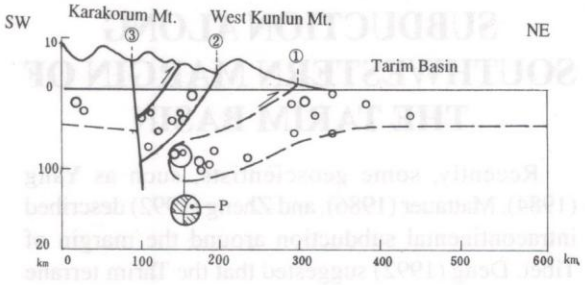

Fig. 4 Seismotectonic profile along the southwestern margin of the Tarim Basin
(1) North Boundary Fault of the West Kunlun Mountains; (2) Kongxiwar Fault; (3) Karakorum Fault; P: p axis showing earthquake mechanism of the Yecheng earthquake which occurred on 14 February, 1980.

termination of the intermediate seismic zone. And so the strong seismic intensity area will be about 90 km north of the microscopic epicentre.

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REFERENCES

Deng Wanming, 1992, Mineralogical features of rock-formation minerals from Cenozoic volcanic rocks of North Tibet. Scientia Geologica Sinica, v.1, No.3/4, pp. 135-147.

Mattauer, M., 1986, Intracontinental subduction, crust-mantle decollement and crust-steaking wedge in the Himalayas and other collision belts. Collision Tectonics, Geological Special Publication, No.19, pp. 37-50.

Molnar, P., and Tapponnier, P., 1975, Cenozoic tectonics of Asia : Effects of a continental collision, Science, v.189, No.4201, pp. 419-426.

Molnar, P., and Deng Qidong, 1984, Faulting associated with lage earthquakes and the average rate of deformation in cenrtal and eastern Asia. Journal of Geopgysical Research, v.89, No.B7, pp. 6203-6227.

Pan Yusheng, 1990, Tectonic features and evolution of the Western Kunlun region. Scientia Geologica Sinica, No.4, pp. 232-241.

Tapponnier, P., et al, 1992, Subduction, crustal folding and slip partitioning along the edge of Tibet. International Symposium on the Karakorum and Kunlun Mountains, Meterological Press,Beijing,Abstract, p. 8.

Tectonic Map Compiling Group, Institute of Geology, Academia Sinica, 1974, A preliminary note on the tectonic features and their development in China. Scientia Geologica Sinica, No.1, pp. 1-17.

Wang Suyun et al, 1992, The Yecheng, Xinjiang earthquake of February 14,1980-A destructive intermediate-focus earthquake Acta Seismologica Sinica, v.14, No. 2, pp.137-143.

Yang Weiran et al, 1984, "Opening" and "closing" in the tectonic evolution of China. Earth Science, No.3, pp. 39-56.

Zhang Zhito, 1985, Geological features of the Altun Tagh fault. Bulletin of Xi'an Institute of Geology and Mineral Resources, Chinese Academia of Geological Sciences, No.9, pp. 20-32.

Zheng Jiandong, 1991, Significance of the Altun Tagh fault of China. Episodes, v.14, No.4, pp. 307-312.

Zheng Jiandong, 1992, Double wedging model for the Qinghai-Xizang (Tibet) Plateau. Proceeding of the First Symposium on the Qinghai-Xizang Plateau, Science Press, Beijing, pp. 302-307.

Zheng Jiandong, 1993, Karakorum fault and Taxkorgan seismic deformation zone. Seismology and Geology, v.15, No.2, pp. 107-116.