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COMPARISONS BETWEEN THE ERTAI FAULT AND SOME TYPICAL STRIKE-SLIP FAULTS IN THE WORLD

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The Kokotuohai-Ertai fault (the Ertai fault in short) is an active fault along the southwest piedmont of the Aertai Mountains, North-East Xinjiang. It starts from the uplifted district of the Aertai Mt., extending undulatorily southward for 200km, and ends at the bank of the Wulungu River, The fault trends NW 342°, dipping to east with 70° dip angle (Fig. 1).

The Ertai fault is the most striking one in a series of NNW-trending active faults in the Aerati Mt.-Western Mongolia region, crossing the

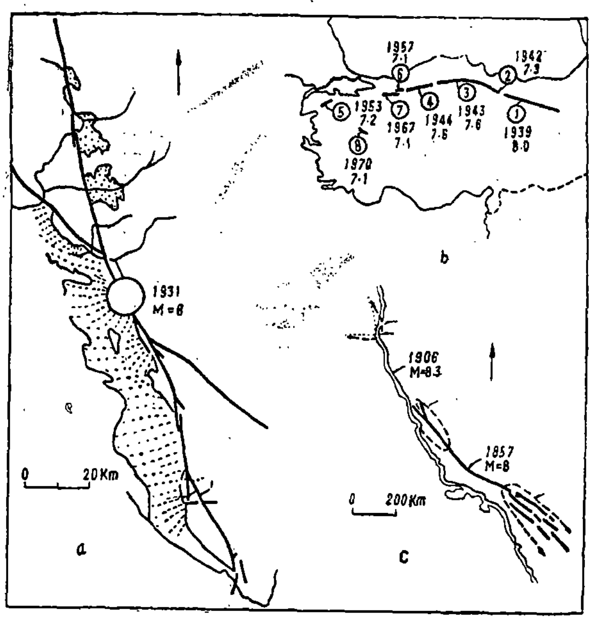

Fig. 1 Maps showing the Ertai fault (a), the San Andreas fault (b) and the North Anatolian fault (c), and distributions of earthquake epicenters along each fault

southern marginal structures of the Aertai Mt. fold belt, the Eerqisi deep seated fault zone and the Halatonggu-Buergen Mt. piedmont depression (on its southern part the Oligocene red type deposit was accumulated). Along this fault strong right lateral strikeslip motion has occured with overall offset up to 26km.

A train of geologicl and geomophological evidences, especially dislocation of drainage systems at all levels, representing horizontal motion along the fault, shows that fault displacement was quite different in individual periods at various segments of the fault (Fig. 2). The average offset rate estimated from dislocation data of 68 gulches since Miocene and Pleistocene epoch is 3 mm/year.

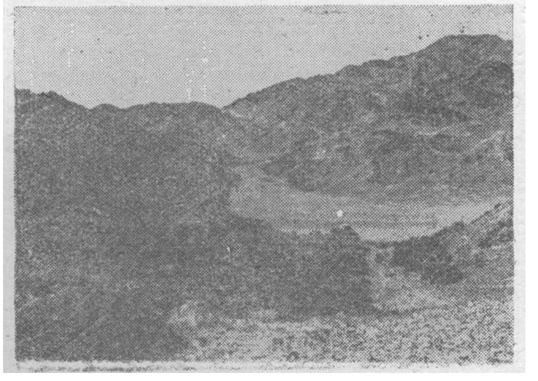

Fig. 2 A photo showing 800 m dextral dislocation in Gangou (Photo by Ge Shumo)

In 1931, a magnitude 8.0 earthquake occured in Fuyun along the Ertai fault, inducing a earthquake fault 176km long. The epicentre of the major earthquake was located at Kalaxiangeer Peak, and the seimic fracture zone spread dominantely southward. The earthquake fault is characterized by a right-lateral strike-slip and variation of displacement along the fault shows a cosine curve feature. The recent small earthquake activity has mainly scattered on the east side of the fault, particularly near the Kalaxiangeer Peak and the southern end of the fault.

A large scale trenching on several segments of the fault revealed a large number of traces of ancient earthquake. For instance, the Late Quaternary deposit outcropped in a test trench 6 m deep suggests that at least 5 events occur since that time. The average recurrence of 4 earthquakes with magnitude of 8 is 3150 years since Holocene epoch.

As compared with the world-famous San Andreas fault in North America and the North Anatolian fault in West Asia, the Ertai fault is of some characteristics similar to them, and, of course, some important differences from them.

SIMILARITIES

1.They are quite similar in the nature and the sense of motion. Although the Ertai fault has a different extending direction and a different pattern of arrangment from the san Andreas fault and North Anatolian fault,all of them have dominantly suffered from a strike-slip dislocation in right lateral sense.

2.In this century, very strong earthquakes in the world have occured along the three active faults, inducing large scale seismic faults. In 1906, on the northern segment of the San Andreas fault, the San Francisco eathquake of magnitude 8.3 occured, resulting in a seismic fault zone of 450km long with dextral offset of 6.4m. In 1939, a M=8.0 earthquake occured along the North Anatolian fault leading to a seismic fault zone of 340km long with a right-lateral offset of 3.7m. In 1931, a M=8.0 earthquake occuried along the Ertai fault, accompanied by a earthquake fault zone of 176km in length with maximun right-lateral offset of 14m.

3.Surface fault trace is composed of many segments which exhibit alternate step-shape in the extending direction rather than a continuous single one, and the fault is obviously characterized by step-shaped displcement.Uplifting or depressing occurred in the alternate part of stepshaped segments depending on stress state. The alternate step-shaped displacement along the Ertai fault and the seimic fault appeared at Kala xiangeer, Sarebasitao, Laoshankou, Yunzhenshan,Xinshankou and Gangou.

4.Along the faults occurred cataclastic and altered rock belts of 100m or more in width. In the north segment of the Ertai fault there is a well developed dynamo-metamorphic belt within which cataclasm and mylonitization occurred. The fault rock samples collected from several sections of the fault show the typical deformation microstructures, such as cataclastic structure, hourglass structure of feldspar, kink band, deformation twin etc. In the granitic cataclasite there are some irregular pseudotachlite veinlet, which are considered as products of ancient earthquakes (Fig. 3).

5.Along these three fault zones there is a common geomorphic featuer, that is the typical morphostructure of strike-slip fault caused by Late Quaternary surface dislocation. Because of great displacement of the faults and lack of large vegetation cover, the landscape is extremely clear. The typical morphostructures are as follows.

Fault scarps: Smoe fault scarps formed during long period motion of the fault, and the feature of scarp appearrence indicates that the fault has a history of mutltiperiodic activity. For example, the newer scarp differs from the older one in color, lsope angle, orientation of slip scratch and mylonite. At Haizigou, Shumiegou, segment of the Ertai fault, can be seen a well-developed big scarp on which there are some long and thick slicklines and mylonite caused by the earlier faulting. The seismic faulting produced by 1931 earthquake extends exactly along the scarp foot line, which represents the repetition of activity of the Ertai fault.

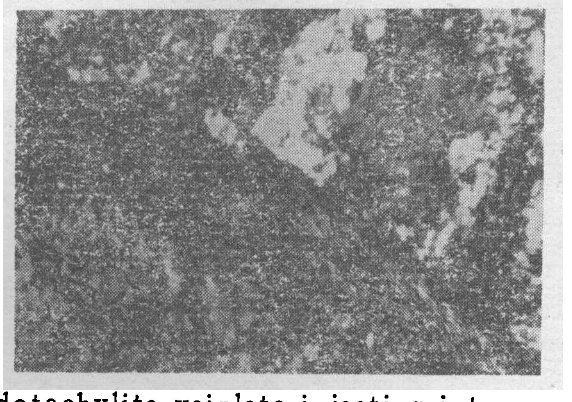

Fig. 3 **Pseudotachylite** veinlets injecting into granitic cataclasite (Photo by Lin Chuanyong)

Fault sag: In the superposed part of alternate stepshaped segments along the Ertai fault, for example, Akesayi, extensional closed fault sags tended to be formed owing to the extension caused by the strike-slip movement of the fault. Even in the Kalaxiangeer, where 1931 great earthquake epicentre was located the fault sag feature can be seen.

Fault valley: Canyons and valley controlled by fault are evidences for most faults. These linear valleys arranged in a line and can obviously be seen on the airphotograph. At the segments of Qiaergou to Akesa-

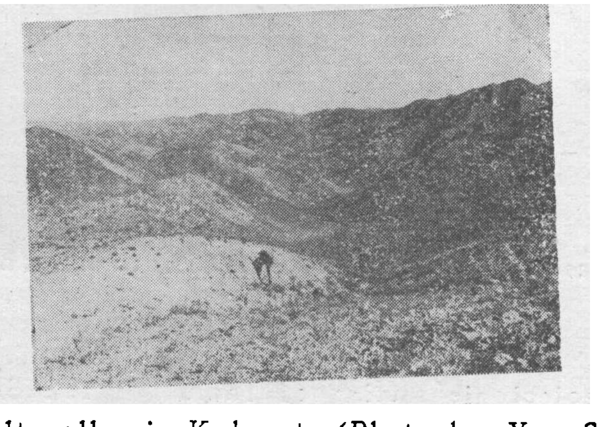

Fig. 4 Fault valley in Kabuerte (Photo by Yao Songmin)

yi, Laoshankou to Kabuerte, where the Ertai fault crossses the mountainland, this kind of morphostructure is pretty well developed (Fig. 4).

The offset drainage system: Horizontal movement of faults resulted in the offset of drainage system. Because of uneven motion of fault and step-shaped displacement, dislocation of drainage systems formed in various periods is different, and that of various segments of drainage system formed in same period is different as well. The slip rate of fault can be estimated from dislocation data of the drainage systems. Such data along the Ertai fault suggests that the offset of small gulches formed in Holocene epoch is from several to 30 meters, from which average slip rate of 3 mm per year may be obtained.

Offset of ridge: When a fault crosscuts erossion hillslopes, horizontal movement along the fault leads to the offsetting of a series of ridges, and then a number of sickle-shaped fault planes are developed, accompanied by cutoff of gulches between ridges and formation of fault sagponds or fault trenches. Just as the offset of drainage system, the offset of ridges varies with localities. From the south of Qiaergou to Akesayi along the Ertai fault, such a morphostructure is very distinguished.

Scissors-shaped fault plane: Horizontal displacement along a fault crosscutting a gulch caused the fault plane on slopes of the gulch to form a scissors-shaped geometry at walls of the fault. The morphostructure is generally accompanied by offset of drainage system, and may be used to estimate the horizontal dislocation. In the Xiabeierte mountain region where the Ertai fault goes through, this sort of morphostructure is well developed (Fgi. 5).

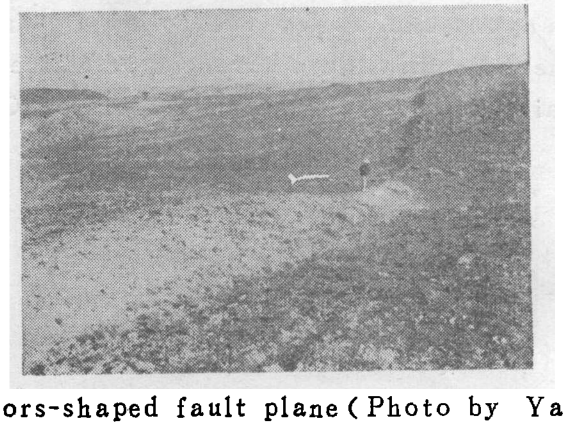

Fig. 5 Scissors-shaped fault plane (Photo by Yao Songmin)

SIGNIFICANT DIFFERENCES

1. Different geotectonic setting of fault Teh San Andreas fault and the North Anatolian fault, extending for more than one thousand

kilometers, are plate-boundary transform faults. The Ertai fault, however,is a tearfault at the block margin of intra-plate continent, extending only for about 200km.

2.Different feature in fault activity　Along both the San Andreas fault and the North Anatolian fault there are some segments on which creep had occurred, along the Ertai fault,however, there is no such phenomenon.

3.Difference in earthquake-prone portion on the fault　Along the San Andreas fault and the North Anatolian fault great historical earthquake occurred at the portions with simple fault trace, while small earthquakes frequently occurred at those portions where fault developed branches. Along the Ertai fault however, large shockes occurred at the rugged segments where the north-west-trending Eerqisi deep fault is crosscut and enticles are developed,while small shocks distributed evenly on thewhole fault,especially concentrated in epicenter regions of the great earthquakes and the southern end of the fault.

4.Difference in total displacement of fault　The total displacement is some 300km on the San Andreas fault, and about 85km on the North Anatolian fault, while only 30km on the Ertai fault.

5.Difference in the rate of relative motion of fault　The rate of horizontal movement along the plate-boundary transform fault is much higher than that along the intracontinental strike-slip fault. In middle California, the relative movement rate across the San Andreas fault is up to 30mm per year, and 10—20mm per year across the Norrth Anatolian fault, whole 3-3.5mm per year averagely since Holocene across the Ertai fault.

6.Difference in great earthquake recurrence interval　There is a high seismic activity on transform fault along the plate boundary,on the intracontinental strike-slip fault, however, great shock recurrence interval is relatively long. The large earthquake recurrence interval on the southern segment of the San Andreas fault is 160ys, and 150ys on the North Anatolian fault, and while up to 3150ys on the Ertai fault, being an order higher than the two formers and between that in Haiyuan area(1600ys) and that in Tangshan area(7500ys).

CONCLUSION

Comparisons between strike-slip fault along plate boundary and intracontinental strike-slip fault indicate that although they are rather similar to each other in many aspects, such as the features of fault movement, pattern of fault configuration, geomorphic appearence and large earthquake activity, they have their own distinct characteristics. The form shows the characteristics of a large scale, higher movement rate and shorter great earthquake recurrence interval; the latter is characterized by smaller scale, lower movement rate and longer great earthquake recurrence interval.

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二台断层与典型走滑断层的比较

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摘　　要

本文对比了可可托海—二台断层与北安纳托里亚断层和圣安德列斯断层，指出了它们在断层运动性质、大地震活动、断层的组合特征以及走滑断层的典型构造地貌等方面都很相似。但是，由于它们所在大地构造部位不同，像二台断层等大陆内部走滑断层的规模一般都小，运动速率较低，大地震复现周期较长；板块边界走滑断层普遍表现为规模大、运动速率高、大震复现周期短的特点。