THE STANDARDIZED CURRENT OF AUTOMATIC TIME—SEQUENCE—CONTROLLED VIBRATION PICK—UP WITH ZZD PERIOD

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由立交模式讨论地震预报

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摘　要

1983年作者在昆明举行的南北地震带会议上提出了立交模式。1985年正式发表(本刊)。本文是上一篇文章的继续，重点讨论了以下的问题。

1.把立交模式应用于解释远距离的大震迁移，具体讨论了横穿青藏高原和鄂尔多斯地台的大震短期迁移现象。这种远距离跨越大地构造单元的震中迁移已往是很难理解的，但是从立交模式来看，则是很自然的。

2.由于下岩石圈近于塑性，且相对均匀，所以在大区域构造压力作用下，其内形成的剪切滑移线与区域压力成45°角，因之如果已知若干地震排成一条线则可认为与其相交45°角的方向就是主压应力方向，这可与震源机制所求得的P轴方向相互补证。依此方法对华南和甘青地区的主压应力方向作了推求。

3.在用相距较远的地震连直线的时候，对于中等强度的地震至少得三个地震连直线，对大震来说，两个即可。这是因为大震的断层面通入地下深，直接受到下岩石圈中蠕滑断层的影响。而中等强度的地震的震源断层面如插入地下浅时，则不直接受这个蠕滑断层的影响，因之取两震连线难排除偶然性。如三震相连则可能是深部蠕滑断层共同制约，不然为何在短时间内它们连成一条线。

4.如果已知区域主压应力方向(用一些大震震源机制所求P轴方向的平均或用其他方法求得)，则当一处发生大震后，可通过震中作与主压应力方向成45°夹角的直线，此直线即为今后震中迁移的较可能的方向，这个直线有时与已发地震的断层走向一致。

5.一些外因，如固体潮和极移等有可能影响下岩石圈中蠕滑断层的动态，并由此影响上岩石圈中大震的发生。这是调制模式的另一种形式，即外因对震源的间接调制。

6.我国震中迁移的事实表明，历史上短期震中迁移的始发地区可能是一个前兆穴位。在该区选择良好观测台址进行前兆观测可监视较大范围内的大震发生，特别是监视历史上震中迁移方向上今后再发生的大震。

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DISCUSSION ON EARTHQUAKE PREDICTION FROM THE STEREOGRAPHIC CROSS MODEL

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In the previous paper, we presented the stereographic cross model to explain the earthquake arranging line and its migration with a long jump distance. This paper accents a discussion on some problems of earthquake prediction and the determination of the principal pressure stress direction with this method.

Brief Introduction of the Stereographic Cross Model

According to brittleness and duntity, the lithosphere can be divided into two layers, the upper lithosphere and the lower lithosphere. The upper lithosphere is brittle, in which a lot of great earthquakes occur along the faults and the other sets. The lower lithosphere is plastic, in which creep faults occur along the long straight lines. The creep faulting in the lower lithosphere may trigger the earthquakes in the upper lithosphere, as seen in Fig. 1 .

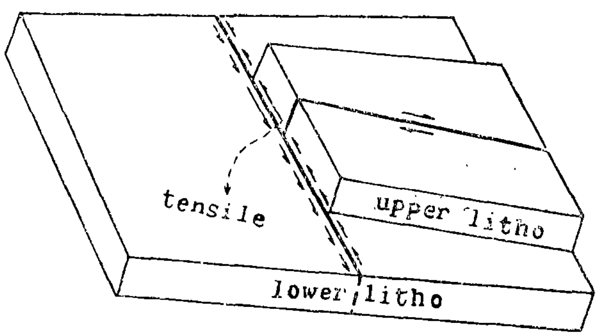

Fig. 1

Because the creep faulting is very long in lower lithosphere, the amplitude of dislocation is not the same in each segment. In this case, some pla ces assume tensile regions,and some,pressure regions.If an earthquake occurs very soon along a fault in upper lithosphere, such tensile and pressure in lower lithosphere may trigger the earthquake to occur.The mechanism of triggering earthquake is stated as follows.

1.Reduction of frictional stress because of tensile stress

When an earthquake is near to occur, on the fault plane there is a relation between shear stress S and frictional stress F.

$$S<F \tag{1}$$

$$F=F_0+\mu P \tag{2}$$

where F_0 is beading strength, μ is frictional coefficient, and P is normal pressure on the fault plane.If the above-mentioned tensile stress appears, the formulas (1) and (2) can be changed into the following:

$$S>F \tag{3}$$

$$F=F_0+\mu(P-T\ \mathrm{Cos}\theta) \tag{4}$$

where T is tensile produced by heterogeneity of amplitude of dislocation along the creep fault in the lower lithosphere.

2.Injuction of fluid from pressure region

When an earthquake is near to occur, the relative pressure due to heterogeneity of creep slip may urge the fluid having a high temperature and various chemical components to flow out from lower lithosphere and inject into the lower edge of fault in upper lithosphere, and a high pore pressure can be formed so that an earthquake may be triggered.The following formulas can describ such a relation:

$$S>F$$

$$F=F_0+\mu(P-P') \tag{5}$$

where P' is pore pressure.Besides, the fluid may produce the stress chemical corrosion, which plays a part in triggering an earthquake as well.

The Explanation to Some Problems of Earthquakes

It was once hard to explain the migration of great earthquakes through Qinghai—Xizang Plateau and Ordos Platform.But from what the stereographic cross model refers to, it's easy to understand why.Now a discussion goes about it by the following examples.

1.The migration of great earthquakes traversing Qinghai —Xizang Plateau

There were four straight lines traversing the Qinghai-Xizang plateau, along which Some great earthquakes with M= 7 −8.5 Occured. The time interval of following earthquakes is less than two years as shown in Fig. 2

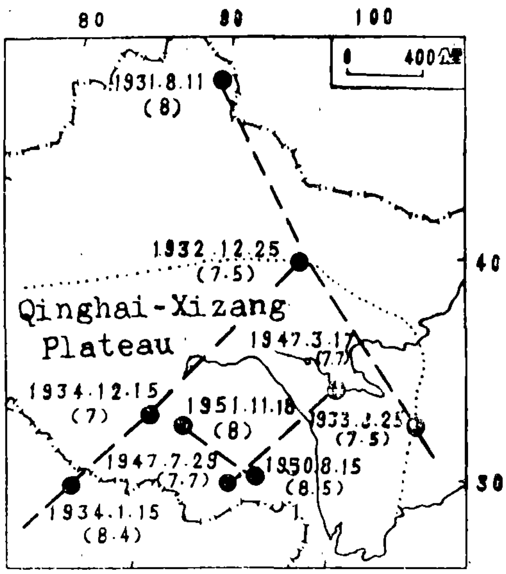

Fig.2 The migrations of great earthpuakes acrossing Oinghai-Xizang Plateau

The connection lines in Fig.2 are crossing the tectonic line in Qinghai-Xizang Plateau. We don't think it's well explained from the viewpoint of present-geological theory. But we think it's available to be explained from the theory of stereographic cross model.

It should be pointed out that the earthquakes' migration arranging lines In Fig. 1, are accordant with the principal pressure stress in this region.

2. The migration of earthquake epicentres across Ordos Block

Ordos Block is a stable region. The direction of NE predominates the migration of epicentres in its periphery. For instance, an earthquake (M=6.5) in 1305, in Datong and the next year (1306) the same magnitude earthquake in Guyuan. Otherwise, the direction of an arranging line between Guyuan earthquake with M=7.0, 1622 and Lingqiu one with M=$7\frac{1}{4}$, 1626, is quite similiar to the above-mentioned direction (Fig 3). In this figure, shaded belts denote the boundary of Ordos block

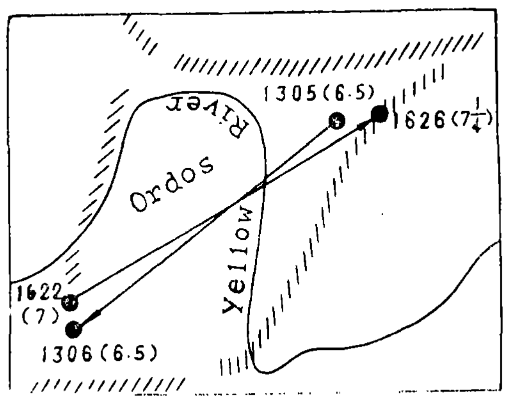

Fig.3 The migration earthq. across Ordos block

If such a diretion of epicentral migration is cotrolled by creep fault in low lithosphere, the direction of principal pressure stress corresponding the creep fault is close to EW, which coincides with the compression direction of Pacific Ocean Plate and roughly with the direction of principal pressure stress determined by the earthquake fault plane solution.

The Determination of the Direction of the Principal Pressure Stress

In accordance with the stereographic cross model, the medium in lower lithosphere is nearly plastic and so there is a 45° angle between the direction of creep fault inside lower lithosphere and the direction of the regional principal pressure stress.On the other hand, the great earthquakes triggered by this creep fault, and its arranging line, can represent the direction of the creep fault.Thus, by means of the arranging line of the great earthquakes' epicentres which occurred following each other, the direction of 45° angle intersecting this arranging line can be worked out, and that is the direction of the regional principal pressure stress.Now let us have a few examples in China

1.in South China

In south China, the migration of epicenters of great earthquakes which were larger and the intervals of which were shorter in history, is shown in Fig.4 .Ifwe knew an earthguake epicenter and direction of regional principal pressure stress we may estimate the possible direction of earthquake migration in the near future.

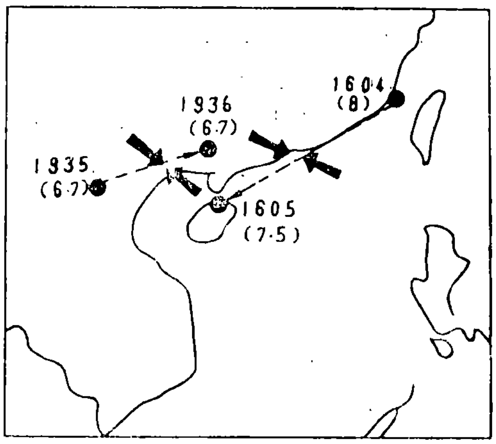

Fig. 3 The direction of principal pressure stress in South China deduced from the stereographic cross model.

2.in Gansu-Qinghai region

Since the beginning of this century, there have been many earthquakes with $M_s \geqslant 6.0$ in Gansu-Qinghai region, among which those migrated their epicenters within two years, can be considered as that controlled the crep faults in lower lithosphere. The direction of principal pressure stress is inferred in Fig. 5 .

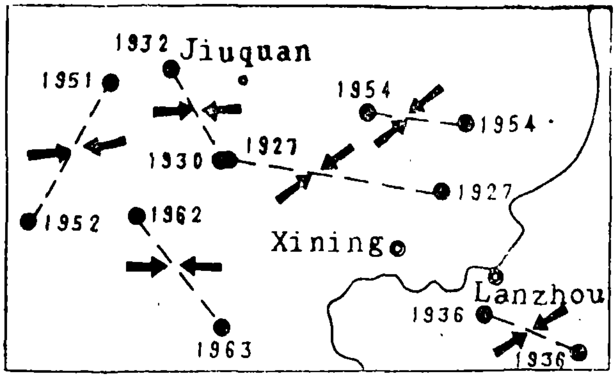

Fig. 5　In Gansu－Qinghai region, the direction of principal pressure stress inferred from stereographic cross model

As the figure shows, the direction of principal pressure stress in this region takes NE and approximately EW as the key, which is close to what is calculated from the data of earthquake waves.

Creep Faults in Lower Lithosphere Modulated by External factors

My viewpoint shows that external factors which can modulate the creep faults in lower lithosphere are likely to be listed as fallows

1. The earth tide

The solid tide acts on the total mass of the earth. It can make lower lithosphere deformed so much that the motion of creep faults inside it could be encouraged to trigger a great earthquake. We take two earthguake migrations for exmples:

(1). There are three earthquakes arranging along a straight line with the strike of NE. They are: Xingtai earthquake with $M=7.2$, 1966, Hejian with $M=6.5$, 1967 and Tangshan with $M=7.8$, 1976, An angle of 45° is formed between the above arranging line and the direction of approximate WE of the regional pressure. Therefore, we believe that the straight line consisted of the three earthquakes is restricted and controlled by the creep fault in lower lithosphere. It is so intriguing that the time when they occurred happened to be at syzygy or at about it, as shown in Fig. 6 .

(2) In 1936, a $M=6\frac{3}{4}$ earthquake occurred in Kangle County, Gansu Province and half a year later a $M=6.0$ earthquake followed it near Tianshui. They formed a straight line in such a short time and it is likely to be done by the abyssal creep faults. And it is interested to find out that they occurred about syzygy as well (Fig 7)

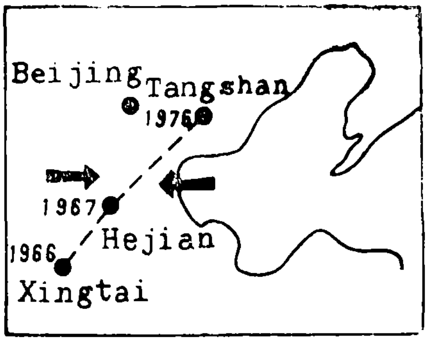

Fig. 6 The solid tide modulation and earthquake migration

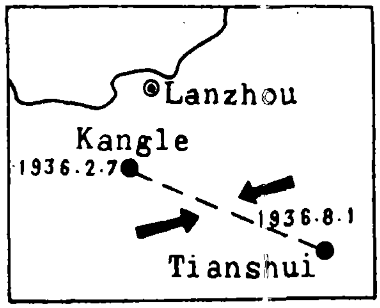

Fig. 7 The solid tide modulation and eathquake migration (The regional principal pressure stress is shown with rough arrow)

2. Polar motion

When polar motion is the most violent, asthenosphere must be in motion so much that lower lithosphere could be deformed, which perhaps urges creep fault to move, and great earthquakes may be triggered in th upper crust. Take M=8.5 earthquake in 1950, in Motuo, Xizang and another M=8.0 shock in 1951, in Dangxong, Xizang. It was at that time when polar motion was the most violent that these earthquakes occurred (Fig. 8)

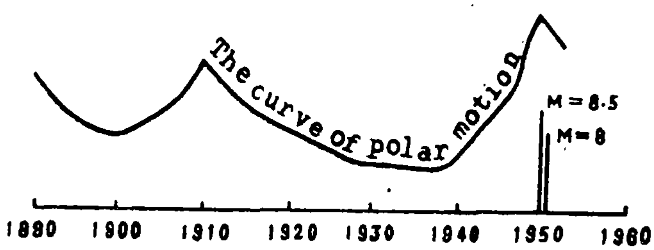

Fig. 8 The relation between polar motion and the two earthquakes: one with M=8.5 in 1950, in Motuo, and another with M=8.0, in 1951, in Dangxong.

It is interesting that before and after 1950, the high tide of volcanic activity in the world supported the global activities in upper mantle during this perion including Xizang Plateau.

A preliminary study has only been done for the modulation to the creep faults in lower lithosphere by external cause, and it needs further study and research. (中文摘要见112页)