THE STUDY OF REMOTE SENSING FOR QINGHAI-TIBET PLATEAU UPLIFT LOCUS

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ABSTRACT:

The Qinghai-Tibet Plateau is youngest and highest plateau in the earth, begin uplift quickly since lower Cenozoic. It make up of many broken pieces, offer a widely study by remote sensing geology, broken pieces and outer edge's mountains have difference geometry movement characteristic, difference uplift velocity among difference broken pieces, but the plateau is aintegrated structuralsystem, has its owner movement characteristic. Many fan type split generation in lower crust of the Qinghai-Tibet Plateau, thedistributing and scale of Cenozoic molasses records uplift velocityof the plateau. Stage uplift of the plateau was discovered by Cenozoic volcanism and volcanism and volcanic rocks, the uplift locus and development trend of the Qinghai-Tibet Plateau are researched by remote sensing geology.

INTRODUCE

The Qinghai-Tibet Plateau is plain to match in order to" the roof of the world". On geological structure, it lies in middle-east location of Tethysstructural domain, between the Indian plate and the Eurasia plate. The two major plates start underriding colliding since lower Cenozoic, Begin fierce orogenic movement and fast grand to uplift and evolve, it is at the largest range to uplift grandly, the youngest Plateau of the globe formed gradually. Colorful geological phenomenon and extremely special structure was made up in the Qinghai-Tibet Plateau, its development trend has been offered the primitive and natural experiment place, for us to probe their grand to uplift locus and evolve trends, also offered a widely study by remote sensing geology.

1. GEOMETRY MOVEMENT CHARACTERISTIC OF MOUNTAIN SYSTEM FOR OURTER EDGE OF QIGNHAI-TIBET PLATEAU

All we know, the dynamics information was kept in the mountain system of Plateau, can bequantification or half quantification through constructing changes trends and structural river system. In the course of the progressive for Crosscut river of mountains, along with difference displacement function of Himalayas curved to spread, Altun slip etc, form" ," to "great turn" this special river system pattern type, The" ," type displacement distance of "great turn" region was confirmed through remote sensing interpretation and half quantitative calculation, We can outline find out movement state in the level direction of the mountain system. The movement of geometry in outer edge of Qinghai-Tibet Plateau takes place because of depending on the Plateau. Remote sensing interpretation of mountain system movement is according with following: A. the

river cutting and wear the mountain or the river system to possess the characteristics of" ." type; B. The movement of mountain make up by several broken lump and small broken piece, small broken lump(piece) can produce the level displacement of the difference with small disconnected broken piece: C. The mountain movement be finished in the progressive course, indicate mountain or broken pieces of relative displacement position take place river block, change its course, situation of flowering backwards etc., but Pull characteristic obvious river system take place bend curved on right angle type constructs; D. Turn round straggly order of having generally by these " ." type, arrange in order, indicate mountain whole and forward neat to slip while moulding heavy ground form on foot, Also write down every son-broken difference on the speed of advancing.

Through the result of remote sensing interpretation found the Himalaya mountains was divided by line of Gangtok –Nyainqntanglha Mountains (see Fig.1), West section slip eastwards; Transect mountain range regard Baxu - Ganzi line, mountains gather by NW, SE two side direction central authorities separately. Assembles from different directions to Pamir Mountains Area separately in assorted mountain range of Xingdukushi mountain, west Kunlun, etc. in west of the Plateau; Altun mountains range demonstrates at EW direction. In a word, outer edge of Qinghai -Tibet Plateau was divided into two parts by Gangtok –Nyainqntanglha Mountains – Golmud mountains system.

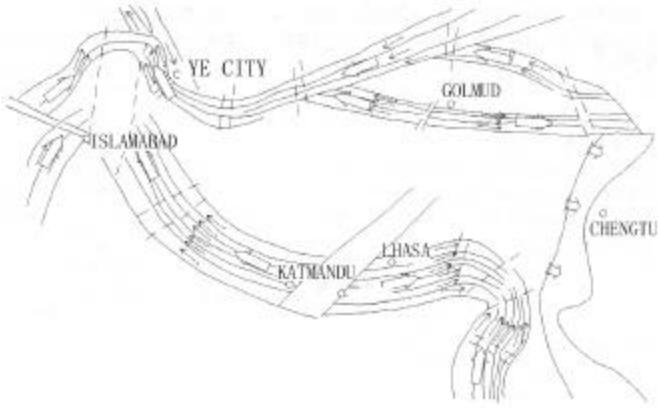


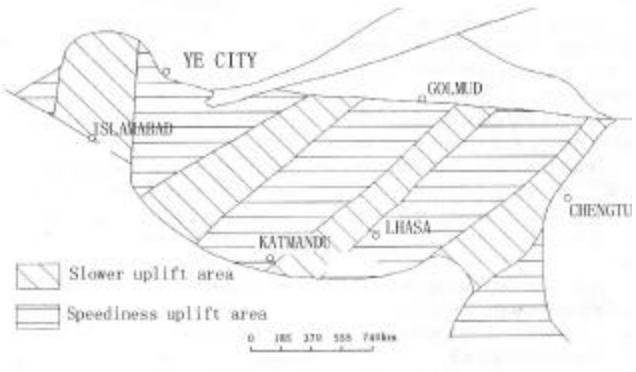
Fig.1 The interpretation Plot of movement characteristic in outer edge of Qinghai-Tibet Plateau

2. THE DIFFERENCE UPLIFT AMONG BROKEN PIECE IN QINGHAO -TIBET PLATEAU

There are distinguishing signs from physiognomy and remote sensing characteristic:

A. The broken piece has a comparatively intact one generally, larger more relatively extend and comparatively steady body and distinct boundary if they quickly uplift or slowly uplift, it is ground form units, such as mountain range, the basin in front of the mountains or the mesa and plain, etc..On remote sensing image, they have relatively intact with the generation one image sign, the accordant tone pattern and assembled image.

B, The quickly uplift broken slump has young ground form view relatively for instance mountain range, and the slowly uplift broken slump keep the old ground form characteristic, for instance plain in front of the mountains, billabong between the mountains, the mesa or plain, etc..



C. The characteristic of denudation physiognomy is conjoin with the quickly uplift broken piece, and their topographic contrast is outstanding, the sharp spine of mountain edge, the development river valley and glacier etc..

Fig.2 Distributing plot of uplift broken pieces at latitudinal direction in Qinghai-Tibet Plateau

But the characteristic of cumulus physiognomy is according to slowly uplift broken slump, the ground degradates, the mountain garden mountain range is bald etc..

D. The cut intension of river system and mountains is a importance sign for the uplift of broken piece

According to judge index while being above -mentioned, macroscopic difference grand to uplift and broken piece appear difference at vertical direction to be calculated in the Plateau, Divide into 18 broken pieces of uplift at EW direction (see Fig.2), 11 difference break pieces of uplift at the direction of SN(see Fig.3), which indicate things broken piece present level alternate tendency upwards in the east and west direction, There is difference of power in the direction. north and south

3. THE FAN TYPE PIECE SPLIT GENERATION IN LOWER CRUST OF QINGHAI-TIBET PLATEAU

Uplift and shorten quickly of Qinghai-Tibet Plateau,has brought up a series of construct expression, which have the same field and period, have different form, multi-form, different mechanics nature and different scale (Hangguoling,1987), The movement of structure in Cenozoic upset or rebuild earlier structure systems in the Plateau.

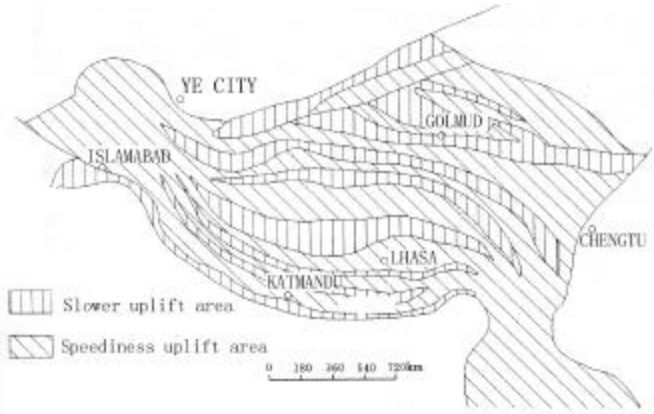


Fig.3 Distributing plot of uplift broken pieces at longitudinal direction in Qinghai-Tibet Plateau

A. The Cenozoic structure develop basis on Brahmaputra suture zone in latitudinal direction, Some whole fan shaped in the lower crust, which show the underpart disappearing closely in the vertical direction, but the top is unfolded and stretch scatter.

B. There are new snap trap zone and snap uplift zone appears in longitudinal direction. For example, it can divide obviously into three structures zone in Qinghai-Tibet Plateau.

C. The structure in longitudinal direction across another structure in latitudinal direction each other in Gangdishi plate, and form "," type structure.

4. THE UPLIFT INFROMATION OF ATHWART NAPPE STRUCTURE FOR THREE TECTONIC NODE IN QINGHAI-TIBET PLATEAU

The three tectonic node were identified in Qinghai-Tibet Plateau through remote sensing interpretation. They are separately, Pamir athwart nappe structure series, Sanjiang (north Tibet) athwart nappe structure series and Taibai mountains nappe structure series. The structure series not only exhibit integer form of Qinghai-Tibet Plateau, but also has the specialty development for themselves.

5. THE CENOZOIC MOLASSES RECORDS FOR QINGHAI-TIBET PLATEAU UPLIFT

The Plateau uplift and slump history was wrote down by the Cenozoic molasses in Qinghai-Tibet Plateau and its neighboring area, on the remote sensing images, the interpretational sign of molasses terrane is red color, discontinuous trip shape and overlay on the other terrane by angle unconformable. The Cenozoic molasses can be divided (from south to north) out in distributing:

a. The molasses group in front of Himalayas, that is Hiwalike molasses group

b. The molasses group of Gangdise, or India river-Brahmaputra molasses group.

c. The molasses group of Bangongcuo-Nujiang.

d. The molasses group of Longmucuo-Roulagangri-Jinshajiang.

e. The molasses group in front of the western Kunlun mountains, or the western regions conglomerate group.

f. The periphery analogous molasses group, it include Bengal,Western Kunlun and Altun mountains etc..

6. THE CENOZOIC VOLACNISM AND VOLCANIC ROCKS

Assemble with granding to uplift with land aggravate, a l arge amount of neutral-acidity and alkaline magma spray and spoil over to the surface of earth, Form the huge and thick volcano rocks stratum. These “excrement” which represent the deep department of the earth, is often called spying on lithosphere structure and" window" or" probe" evolved by petrologist, the setting environment wrote downrespectively grand main structure activity and time for the Plateau uplift.

While volcanism and volcanic rocks studying of remote sensing in the Cenozoic for the Plateau, the volcanic rocks have been divided (from south to north) out in distributing:

a. Volcanic rocks zone of Gangdise in lower Cenozoic, b. Volcanic rocks zone of Bangongcou-Nujiang in middle Cenozoic, c. Volcanic rocks zone of Qiangrimacha-Geladangdong in late mid-Cenozoic, d. Volcanic rocks zone of Hoh Xil basin in upper Cenozoic,e. Volcanic rocks zone of Heishibeihu-Altun and Tenchong in upper Neogene.

Come to light, the first 4 volcanic rocks zone volcanism was synchronous to the Plateau uplift, their ages gradually become younger from south zone to north zone, the lithology transition prejudiced basicty into prejudiced alkalinity, and the volcanism become more and more. There are still volcanism in Heishibeihu and Tenchong volcanic rocks zone up to today, which sign the Plateau uplift is full activity.

7. THE CINOZOIC GRANITE ROCKS GRANITE ROCKS OF QINGHAI-TIBET PLATEAU

There is youngestmagmatic activity at the earth, which output inmagmatic activityat the period of Cenozoic Himalayas. Follower India plate strong extrusion action to Siberia plate, massive granite rocks bring.

On the remote sensing images, the rock body is regarded isolating, integrated, close down, distinct boundary of country rock, the rock body is roundness or ellipse, radiated and converged water system. On the physiognomy, the rock body always hold ontiptop of topography, is often accompanied by snow-covered and glacier mountain, the glacier or snow-covered mountain is arc shape mountain at this moment, snow line is according with the contact boundary of rock body.

8. UPLIFT LOCUS AND DEVELOPMENT TREND OF QINGHAI0-TIBET PLATEAU

8.1. The physique of Qinghai-Tibet Plateau uplift locus

According to the archaeomagnetism data (Zhou Yaoxiu etc.,1983), Qinghai-Tibet Plateau began great orogenic movement at upper Cretaceous period. Such as Lhasa's palaeolatitude is 19.5°,Dazhuka's palaeolatitude is 22.0°and Jiangzi's palaeolatitude is 4.5°at this moment.

The suture zone, which lie in north Bangonghu-Nujiang suture zone, has been piece together during Paleocene and Eocene. The rock mass close northward in south Bangonghu-Nujiang, which in the shape of island, such as Gangdise, Lageigangri, Himalaya etc., the tethys dwindle sharply sea width. Geologist, Estimating the altitude of the Plateau is1000 m at this moment, Young body of the Plateaucome into being, which depend on the north of Gangdise.

Himalaya orogenic movement start formally during Oligocene and Miocene Epoch (25-50Ma), the young body Plateau begin slowerly grand to uplift, all island have been piece together in south of Brahmaputra suture zone, the tethys channel disappear completely, north Tibet come into being.

It is uplift mainly of the Plateau during paleocene and middle Pleistocene (2-12Ma), the first huge and thick molasses was deposited on south of Himalayas. Brahmaputra suture zone lead beginning collide by land to land, the Plateau start overriding and squeezing northwards once, muscovite granite zone and binary granite zone were come into being in Laguigangri area. Mafic volcanic rock zone break forth in Banbonghu-Nujiang area.

During upper Pleistocene and Holocene, the crust level shorten and grand to uplift further stronger whole, Important uplift grandly has taken place twice in shorter interval in the Plateau, second phase and third phase molasses of Hiwalike group were deposited strongly, the western regions molasses group north Plateau and Longmenshang molasses group east Plateau were pile up at the same time. muscovite granite zone andbinary granite zone emplaced in High or lower Himalayas, which is the south boundary of Plateau. Volcanic rocks zone of Hoh Xil basin is the north boundary of Plateau, three nappe structure construct development finish, The whole outline of Plateau takes shape, it infer that the altitude may highly exceed now.

8.2. The evolvement of upper crust of Qinghai-Tibet Plateau

Qinghai-Tibet Plateau uplift accomplish, lower crust evolvement of the Plateau was tracked by remote sensing technology at Holocene or early, The tectonic movements of the following three formals are happenning in the Plateau:

A. Vertical direction in Qinghai-Tibet Plateau

a. Each secondary construct and break piece of EW trend display uplift in different characteristic along India - Dunhuang section, two break piece relative disparity between broken one are in about 500m. Remote sensing study proved including Mount Qomolangma (8848 ms) high Himalayas broken piece at grand negative uplift.

b. Section along Pamir to transect mountain range, secondary construct and break piece of NNE trend display make up arrange, synchronous grand uplift, ladder characteristic that form highly falls progressively from west to east, altitude drop to 4000m averagly from 5500m.

B. Horizontal direction in Qinghai-Tibet Plateau

The mountain range of outer edge of Plateau , such as the Indian plate, Tarim Basin plate, yangtse plate squeeze each other, conversion with Pamir, three river and Taibai mountain nappe tectonic, these plate movement according to each mechanical mechanism, which drive movement of the Qinghai-Tibet Plateau. The fact explanatory note Plateau where the level of mountain range of outer edge movement is in the course of growing up, Increase sharply the crust thick, perimeter construct slip etc., is absorption and

digestion course of acting force.

C. Surface variation in Qinghai-Tibet Plateau

The study of remote sensing result is proved, Modern Plateau nearly the earth's surface take place whole piece split in EW direction, fault depression zone alternate with snap swell zone arrange in longitudinal direction.

8.3. Development trend of Qinghai-Tibet Plateau

According to the research of remote sensing geology, predict that development should display concretly in the followering three respects to evolve the trend in the future of Qinghai-Tibet Plateau:

A. There is a tendency expanded constantly in the range of Qinghai-Tibet Plateau, reach the position in front of Altun mountains in the north of the concrete range, southwest to Ganges River Basin, southeast to the Bay of Bengal, in front of mountain of Longmen in east.

B. The main body of Qinghai-Tibet Plateau grand to uplift and accelerate, Gangdise and Laguigangri mountains will be grow up, but Negative uplift to remain unchanged grandly in The Himalayas, Kunlun mountains.

C. Plateau in Pamir, transect mountains range two district formed uplift in the newly developed area grandly fast.

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