Key Reason for the Significant Differences between Earth and Mars/Venus — An unexpected discovery in the study of plate breakup model

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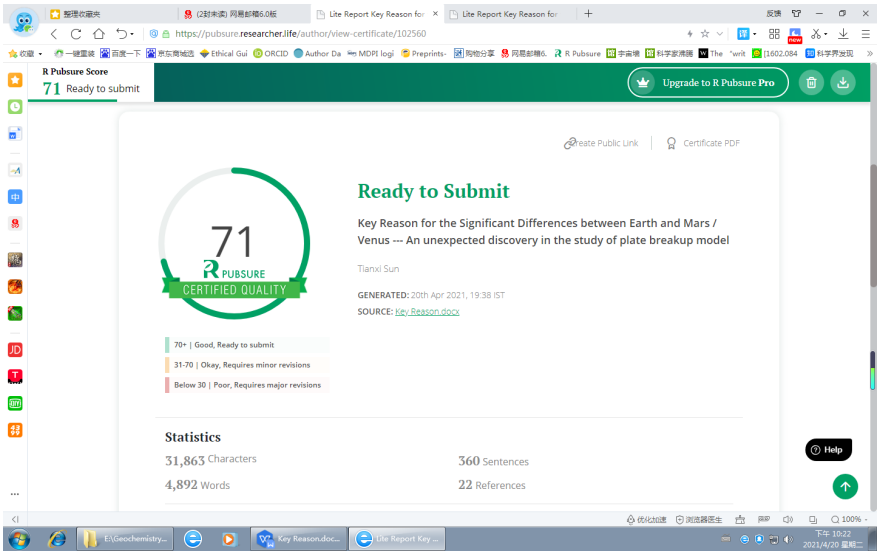
Abstract

The splitting of the plates with SN strikes was attributed to the maximum principal stress field accumulated by the rotation of the Earth. The course of the plate breakup is as follows: any plate has to undergo 5 stages before breaking up; the 5 stages own each tectonic system; the strikes of these 5 tectonic systems gradually deflect 15° towards the rotation axis of the Earth; and after entering the 5th stage, the plate will normally be broken up. This model is supported by experiments and verified using real data from the China Plate, deriving some important conclusions. The five-stage model of plate breakup can explain the linear characteristics of rift valleys and oceanic ridges, which other hypotheses in terms of mantle convection, hot-spots and mantle plumes cannot be explained. Theoretically, the significance of this study might be its filling in gaps in the field of plate tectonics. In addition, this model unexpectedly came to a relatively simple account of why Mars and Venus do not look as our Earth has an entire plate breakup and subsequent florid biological world, mainly because of the 5° deviation between Earth and Mars (or Venus) in the direction of the resultant force that their lithospheric plates have gone through, respectively. The 5° deviation created our distinctive Earth and human beings. Throughout the Solar System, almost all planets are regular spheres except our Earth, which may be why humans is so lonely!



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Key Reason for the Significant Differences between Earth and Mars/Venus

--- An unexpected discovery in the study of plate breakup model

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Highlights

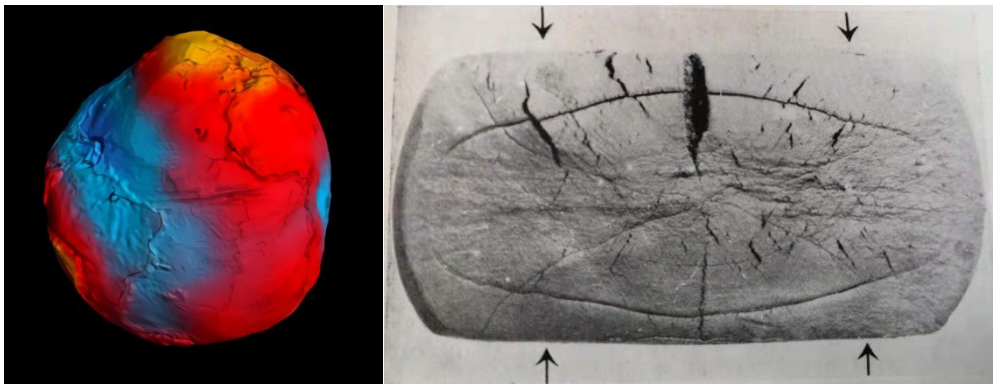
- The author originally wanted to study the mechanism of plate breakup based on the stress field.
- The plate breakup model can explain the linear characteristics of rift valleys and oceanic ridges.
- This model is supported by experiments and verified using real data of China Plate.
- Unexpectedly discovered the key reason for the significant differences between the Earth and Mars/Venus.
- The key reason maybe a 5° deviation between Earth and Mars/Venus in the direction of the resultant force exerted on the plates.

Abstract

The splitting of the plates with SN strikes was attributed to the maximum principal stress field accumulated by the rotation of the Earth. The course of the plate breakup is as follows: any plate has to undergo 5 stages before breaking up; the 5 stages own each tectonic system; the strikes of these 5

tectonic systems gradually deflect 15° towards the rotation axis of the Earth; and after entering the 5th stage, the plate will normally be broken up. This model is supported by experiments and verified using real data from the China Plate, deriving some important conclusions. The five-stage model of plate breakup can explain the linear characteristics of rift valleys and oceanic ridges, which other hypotheses in terms of mantle convection, hot-spots and mantle plumes cannot be explained. Theoretically, the significance of this study might be its filling in gaps in the field of plate tectonics. In addition, this model unexpectedly came to a relatively simple account of why Mars and Venus do not look as our Earth has an entire plate breakup and subsequent florid biological world, mainly because of the 5° deviation between Earth and Mars (or Venus) in the direction of the resultant force that their lithospheric plates have gone through, respectively. The 5° deviation created our distinctive Earth and human beings.

Graphical Abstract



Keywords: Plate Breakup; Model; Linear characteristics; Direction of the resultant force; 5° Deviation; Discovery..

1. Introduction

Since the 1960s, many scientists have felt much interest in plate breakup and tried to explain it with mantle convection, hot-spots, etc.

However, as Armstead once said: these hypotheses can't explain the fact that the spatial arrangements of oceanic ridges and continental rifts are linear(Armstead, 1973).

To solve this problem, I propose a five-stage model of plate breakup.

This model is supported by experiments and verified using real data from the China Plate, deriving some important conclusions.

It is necessary to point out that, an important discovery was made by accident in the study of plate breakup model: the key reason for the great differences between Earth and Mars/Venus might be a 5° deviation between Earth and Mars/Venus in the direction of the resultant force exerted on their lithospheric plates.

2. Some premises

The synopsis of the plate breakup mode is as follows: any plate has to undergo 5 stages before breaking up; each stage owns each tectonic system; the strikes of these 5 tectonic systems gradually deflect 15° towards the rotation axis of the Earth; and after entering the 5th stage, the plate will normally be broken up.

Several premises must be clarified before discussing this model.

2.1. Internal frictional angle of lithospheric plate as a whole

Overall, the internal frictional angle of the lithospheric plate should be assumed as:

$$\phi_{\text{- plate}} = 10° \quad (1)$$

Tectonic geologists have been used to conduct tectonic model experiments using mud materials. Most geologists believe that the simulation of large geological bodies with mud cakes conforms to the principle of similarity.

In effect, the solution of the focal mechanism can be interpreted very satisfactorily by two orthogonal perpendicular shear cracks, which is powerful evidence of $\phi_{\text{- plate}} = 10°$.

2.2. Gradually deflecting 15°

The tectonic belts with strikes of N50°E, N35°E and N20°E in East Asia were named Old-, Mid- and Neo-Cathaysian respectively, in China(Lee,1929). The strikes were gradually deflected at 15°. Currently, longitudinal tectonic belts of the N5°E strike should be produced in East Asia, because the lithosphere is pressed in a direction near EW by the Pacific Plate's underthrusting towards the west. Oh, the 15° style emerges once more.

A clear pattern of gradually deflecting 15° is shown in Table 1(Sun, 1983).

Table 1. Five Stages in Plate Breakup on Our Earth

(in shape of three-axis ellipsoid; take example by plates in East Asia)

Stage	1	2	3	4	5
Direction of principal compressive stress	N5°E - S5°W	NW - SE → EW Gradually deflecting 15°			
Corresponding tectonic system	Latitudinal	Old-Cathaysian	Mid-Cathaysian	Neo-Cathaysian	Longitudinal
Strike of main shear plane		N45°E	N30°E	N15°E	0° Shear rupture
Strike of main tectonic line	EW	N50°E	N35°E	N20°E	N5°E

Based on Tianxi Sun (1983)

Deflecting 15° has proved the inheritance and causality of Earth's tectonic movements.

The following pattern may exist: regional tectonic lines within the eastern parts of the plates in the Northern Hemisphere gradually deflect 15° counter-clockwise and the lines within the western parts gradually deflect 15° clockwise, just opposite to the Southern Hemisphere. That is, it turns toward the rotation axis of the Earth.

92 **2.3. Resultant force by which lithospheric plates would be subjected**

93 When the Earth rotates, lithospheric plates are squeezed mainly by a south-north(SN)
94 horizontal component of the resultant force of the longitudinal force and gravity(Van
95 Bemmelen, 1975). Considering the fact that the shape of our Earth is a three-axis
96 ellipsoid similar to a pear(Combined Diagram **1-A**)(ESA, 2011), it might be assumed
97 that the resultant force of the lithospheric plate within eastern Asia might turn
98 deflect slightly, with a direction of N5°E-S5°W(Table **1**).

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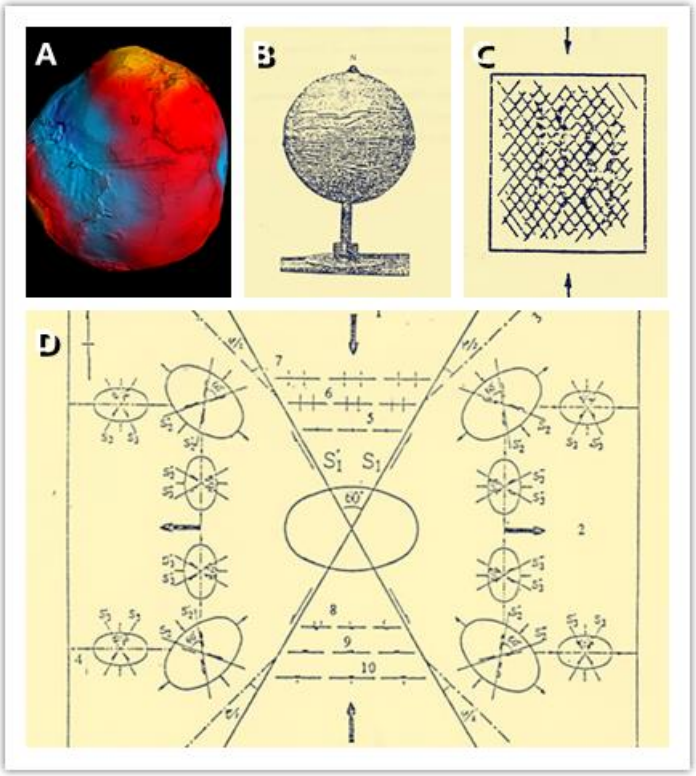

Combined Diagram 1

A. New GOCE Geoid of Our Earth

(Image: European Space Agency, 2011)

B. Latitudinal Structures Formed by Model Experiment on Rotating Globe

C. Two Sets of Shear Planes on Mud Sample

D. Relation between Primary and Secondary Stress Fields during Tectonic Movement

where φ = internal frictional angle; S1, S1'= shear ruptures; S2, S2'= shear ruptures under the 2nd stress field; S3, S3'= shear ruptures under the 3rd stress field

1: maximum principal stress (compressive stress) , 2: minimum principal stress (tensile stress), 3: secondary fold axis, 4: the 3rd fold axis, 5: erect rock stratum, 6: synclinal axis, 7: anticlinal axis, 8: reversed fold axis, 9: thrust fault, 10: overthrust fault.

119 It is very important that our Earth is such an irregular sphere, which differs from
120 Venus or Mars. This may be able explain why Mars and Venus do not look as our
121 Earth has an entire plate breakup and subsequent florid biological world（please see
122 Section 5 in detail）.

123

124 3. The five-stage model of plate breakup

125 In this force field, the plate breakup model for East Asia is as follows:

126 3.1. The 1st stage

127 Because the plate was squeezed in the direction of N5°E-S5°W (Section 2.3),
128 latitudinal compressed zones were first formed.

129 EW folds were first formed after rotating a globe that was coated evenly with mud
130 test materials(Combined Diagram **1-B**)(Sun and Zhang, 1980).

131 3.2. The 2nd stage

132 Two sets of principal shear fracture zones then appeared within the plate; the
133 bisectors of their acute angles were parallel to the longitudinal force (Combined
134 Diagram **1-C**) (Zhang and Zhong, 1977).

135 In rock mechanics, there is a formula(China Wuhan Geology Institute, 1979) as:

136 $$\alpha = 45° - \phi/2 \qquad (2)$$

137 *where α is an included angle between the shear fracture zone and the maximum principal*

stress axis; $\phi_{\text{- plate}} = 10°$ (please see Equation 1).

We determined that α was 40°, so the strike of shear zones in the eastern part of the plates within East Asia in that stage should all have been N40°E, if our Earth were in the shape of a standard sphere.

However, the direction of the resultant force subjected to the lithospheric plate within eastern Asia might turn deflect slightly, becoming N5°E-S5°W(Section 2.3), that is, it might be deflected by approximately 5°. Thus, the strike of the shear zones in the eastern part of the plates within East Asia in that stage became N45°E.

Regional compressive belts can be derived from shear zones. The included angle β between the compressive belt and the shear zone is shown in Combined Diagram **1-D**.

According to a law as shown in Equation 3 (National Institute of Geology, Academia Sinica, 1972), β can be given as:

$$\beta = \phi/2 = \phi_{\text{- plate}}/2 = 10°/2 = 5° \quad (3)$$

Therefore, the strike of the regional compressive belts in that stage should be N50°E, which, is the mechanical cause of Old-Cathaysian(Table 1).

Many experiments mentioned above and those by Sih (1973) testified the above expression.

3.3. The 3rd stage

157 N30°E new shear zones then appeared in the eastern part of the plate with a
158 deflection angle of 15° from the N45°E old shear zones that had been formed during
159 the 2nd stage. Therefore, the new shear zones could also derive some N35°E new
160 regional compressive belts with an included angle of 5°(Equation 3). This was the
161 mechanical cause of Mid-Cathaysian(Table 1).

162 Doerner(1948) pointed out that new sliding planes must deflect gradually toward
163 the compressive stress axis under a single compression(Combined Diagram **2-E**).

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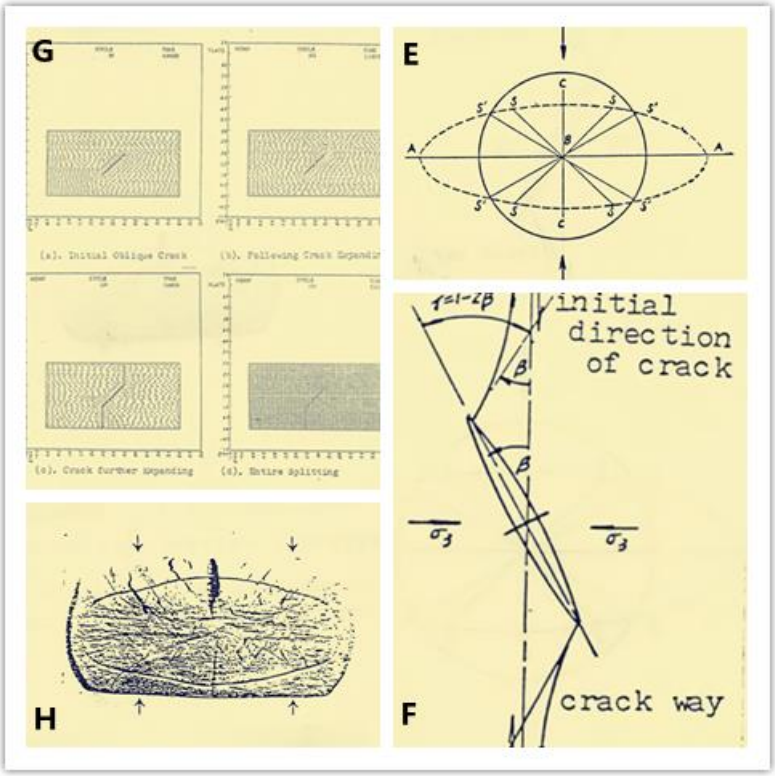


Combined Diagram 2

E. New Sliding Planes under Simple Compression
(where S'S' are sliding planes of the earlier period; SS are new ones.)

F. Crack Expanding Direction from Ends of Non N - S Elliptic Crack under Compression

G. Crack Expanding Prediction with Oblique Crack under EW Tension
(a: Initial oblique crack; b: Following crack expansion; c: Crack further expanding; d: Entire splitting)

H. Splitting of Mud Cake

3.4. The 4th stage

Subsequently, N15°E newer shear zones appeared with a deflection angle of 15° from the shear zones that had been formed during the 3rd stage. These zones could also derive the N20°E newer regional compressive belts with an included angle of 5°. This was the mechanical cause of Neo-Cathaysian(Table 1).

Stagg(1978) indicated that the direction of crack expansion must be toward the load under a single compression(Combined Diagram **2-F**).

3.5. The 5th stage

Finally, the two sets of shear zones that had formed during the 4th stage, one of strike N15°E in the eastern part and the other of strike N15°W in the western part of the plate, again deflected 15° towards the rotation axis of the Earth, producing an extremely strong 0° (south-north strike) shear rupture, which was parallel to the maximum principal stress axis, by way of the two sets of shear planes combined into one shear plane, thus creating a south-north direction's whole breakup in the plate(because the shear cracks during the 2nd stage to the 4th stage were produced by a simple shear, thereby preventing splitting of the entire thickness of the plate). Hence, the plate was entirely split, ending the entire breaking course. Of course, this 0° shear rupture could also derive its compressive regional belts of N5°E and N5°W strikes, that is, longitudinal belts(Table 1).

* Sih(1977) considered that under EW tension(i.e., under SN compression), a non SN oblique crack could still be split in the SN direction, based on his experiments(Combined Diagram **2-G**).

* An experiment by Zhang(1985) showed an axial splitting of a mud cake under simple compression(Combined Diagram **2-H**).

Combined Diagram **2-H** seems to be an excellent epitome for the entire course of plate breakup. Why can we not look upon this result as strong evidence to

supporting the model of plate breakup? Interestingly, the experiment shows that plate breakup often occurs in the middle of the plate. Bonnin, J. and Dietz, R.S. also once said that oceanic ridges often remained in the middle of two plates(Bonnin and Dietz, 1977).

There could be several phases during the plate breaking occurred:

A. 0° shear rupture (initial splitting);

B. Hot mantle arched upward along the 0° (SN) linear split, leading a linear plate breaking with a SN direction (final breakup).

C. As the movement of plates dredged up rock from the depths and brought it back down again, it could have transported both water and carbon dioxide. The recycled carbon dioxide may have generated, or at least helped sustain, a dense, carbon-rich atmosphere. This blanket of greenhouse gas could have warmed our Earth.

Strikes of oceanic ridges/rises and continental rifts on Earth are mostly SN. For example, the Atlantic Mid-Ridge, the East Africa Rift, etc.

However, the non SN strikes, perhaps because they were secondary structures(please see Combined Diagram **1-D**) such as the oceanic ridges/rises with EW strike. Their basements are always sialic(Li, 1983).

4. Model verification: breaking history of China Plate

The principal compressive stress that the China Plate was borne since the earlier Archaeozoic Era has undergone 4 cycles. Changes of "the Directions of the Principal Compressive Stress" (abbreviation "DPCS", the same below) in each cycle were much the same: nearly SN → NW-SE → nearly EW (please see Table 2):

4.1. The first cycle

4.1.1. The 1st stage

The DPCS during the early Archaeozoic in the China Plate was nearly SN, beginning the 1st cycle. Closed fold groups and motamorphic rock belts with nearly EW strike, appeared in the Qinling and Yinshan Mountains during the early Archaeozoic(National Institute of Geology, Academia Sinica, 1980).

4.1.2. The 2nd ~ 4th stages

The DPCS during the late Archaeozoic was gradually from NW-SE to NWW-SEE. Multiple folds and gneissic structures of NE strikes produced in the late Archaeozoic were found in the Fuping and Shanhaiguan regions(National Institute of Geology, Academia Sinica, 1980).

Table 2. Breaking History of China Plate

Cycle	1			2		
Stage	1st	2nd ~ 4th	5th	1st	2nd ~ 4th	5th
Era	Early Archaeozoic Era	Late Archaeozoic Era	Early Proterozoic Era	Middle Proterozoic Era	Palaeozoic Era	Triassic period
DPCS	~SN	NW-SE to NWW-SEE	~EW	~SN	NW-SE to NWW-SEE	~EW
Break -up?			Yes			Yes
Breakup in China	Panxi Palaeorift Valley started breaking up 2,000 Ma.			1.Tanlu Palaeorift started breaking up about 190 Ma; 2. Fenhe Graben was formed 190 Ma.		
Mutation in World	At the same time as 2,000Ma, lot of mutations in the world were happened: Reducing atmosphere → oxygen atmosphere; Large-scale and rapid polar migration.			At the same time as 200-190Ma, lot of mutations in the world were happened: Pangaea super-continent started breaking up; Large-scale polar migration.		

(continued)

Cycle	3			4		
Stage	1st	2nd ~ 4th	5th	1st	2nd ~ 4th	5th
Era	Early and Middle Jurassic Period	Late Jurassic ~ Cretaceous Period	Eogene Period	Miocene Epoch	Pliocene Epoch ~ Quaternary Period	Holocene Epoch
DPCS	~SN	NW- SE to NWW-SEE	~EW	~SN	NW- SE to NWW-SEE	~EW
Break -up?			Yes			future
Breakup in China	Fenwei Graben and Bohai Sea Rift were formed in Eogene.			The North China Continental Margin Basin is experiencing a stretching mechanism caused by the linear uplift activity of the upper mantle similar to the marginal sea.		
Mutation in World	At the same time, lot of mutations in the world were happened: Several marginal seas appeared; obvious polar migration.					

(By Tianxi Sun, 2021)

4.1.3. The 5th stage

In the early Proterozoic, the DPCS was nearly EW. The appearance of longitudinal belts marked to enter the 5th stage. The Luliangshan Mountain Anticlinoriums with a strike of nearly SN were produced at that time(National Institute of Geology, Academia Sinica, 1980).

Based on the plate breakup model, the China Plate would be split up during the 5th stage.

Evidences: **Panxi** R**ift** started breaking up 2,000 Ma(Teng and Wei, 1987).

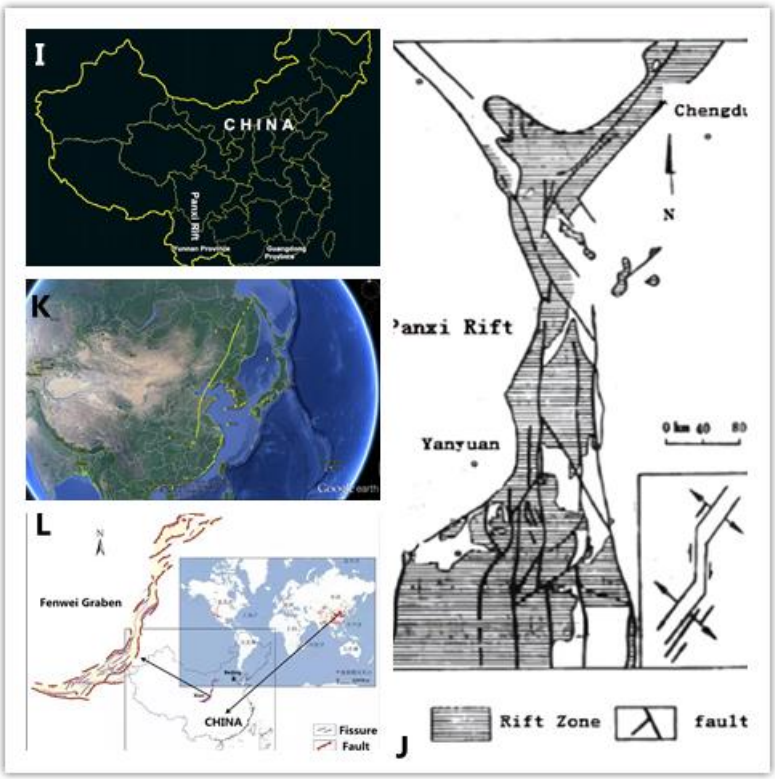
The Panxi Rift stretches to more than 700 km. Its width ranges from tens of kilometers to over 200 km(Combined Diagram **3-I** and **J**) .

The rift nature of the Panxi Rift is clear(Teng and Wei, 1987). The Panxi Rift is the most complete and typical continental rift valley in the world (Yang, 1989).

At the same time, some mutations in the world were happened:

*Reducing atmosphere → Oxygen atmosphere(Ye, 1977);

*Large-scale and rapid polar migration（Briden, 1977）.



Combined Diagram 3

I. Location Map of Panxi Rift Zone
(By Tianxi Sun, 2021)

J. Panxi Rift Zone, China
(By Chan, J.Z. et al., 1985)

K. Tanlu Paleorift
(based on: Google earth)

L. Fenwei Graben
(By School of Geodesy of Geomatics, Wuhan China, 2017)

4.2. The second cycle

After broken up 2,000 Ma, the China Plate began its new dynamical course.

4.2.1. The 1st stage

The DPCS during the middle Proterozoic was nearly SN, again entering the 1st stage. The Yanshan Subsidence Zone with EW strikes was produced at that time(National Institute of Geology, Academia Sinica, 1980).

4.2.2. The 2nd ~4th stages

The DPCS during the Paleozoic was gradually from NW-SE to NWW-SEE. Giant anticlines and synclines with strikes of NE and NNE appeared in the Wutai and Taihang regions at that time(National Institute of Geology, Academia Sinica, 1980).

4.2.3. The 5th stage

The DPCS during the early Triassic was EW. The appearance of longitudinal belts marked to enter the 5th stage. Large folds and subsided fault basins with SN and NNE strikes developed in the Lvliang and Taihang Mountains in the early Triassic (National Institute of Geology, Academia Sinica, 1980).

Based on the plate breakup model, the China Plate was split again.

Evidences:

* **Fenhe Graben** with a strike near SN was formed at the end of the Triassic(National Institute of Geology, Academia Sinica, 1980).

299 ***Tanlu Paleorift** (Combined Diagram **3-K**) with a strike of near SN started breaking

300 up about 190 Ma. It stretches 2,400 km.

301 The Tanlu Great Fault Zone belongs to a rift valley on the basis of:

302 * A preliminary conclusion about the paleorift is obtained through reconstruction

303 of paleotectonics and paleogeomorphology, elucidation of magmatic evolution and

304 deep structures, and comparison with some typical rifts in the world (Xu, Zhang and

305 Zhao, 1982);

306 * The Yitong ~ Shulan graben at the northern part of the Tanlu Great Fault Zone

307 has been recognized as a rift valley (Liu, 1993);

308 * The discovery of the Mesoproterozoic sulfide black chimney group in Xinglong

309 (Hebei Province, Northern China) in 2005, indicated that Xinglong within Tanlu Great

310 Fault Zone was in a position of an oceanic rift hydrothermal vent at that time(Li, et

311 al., 2005).

312 At the same time, some mutations in the world were happened:

313 *"Pangaea, a supercontinent ... started breaking up approximately 200 Ma"

314 (Cambridge Dictionary: Pangaea, ?);

315 * Large-scale polar migration（Briden,1977）.

316 **4.3. The third cycle**

317 After broken up 190 Ma, the China Plate began its new dynamical course again.

4.3.1. The 1st stage

The DPCS during Early- and Mid-Jurassic was nearly SN, entering the 1st stage again. Coal basins with EW strike were formed in Hebei Provence at that time(National Institute of Geology, Academia Sinica, 1980).

4.3.2. The 2nd - 4th Stages

The DPCS from Late Jurassic to Cretaceous was from NW-SE to NWW-SEE gradually, meaning to be from the 2nd stage to the 4th stage gradually:

*A Old-Cathaysian belt(please see Table 1) of NE strike was formed in Lvliang and Taihang Mountains during J_3-K_1(National Institute of Geology, Academia Sinica, 1980);

*NNE strike's Neo-Cathaysian Faults(please see Table 1) were formed during K_2-K_3, appeared in Hebei Province(National Institute of Geology, Academia Sinica, 1980).

4.3.3. The 5th Stage

The DPCS during Eogene was nearly EW, entering the 5th stage once more. About 40 Ma, the Pacific Plate changed its direction of motion relative to the Eurasia Continent from NNW to NWW(Uyeda and Miyashiro, 1974).

Based on the model of plate breakup, the China Plate would be split once more.

Evidences: From Eogene Epoch, **Fenwei Graben**(Combined Diagram **3-L**) and **Bohai Sea Rift** were formed(National Institute of Geology, Academia Sinica, 1980). Some

scholars even claimed that **Bohai Sea Rift** had developed to the Red Sea stage in Eogene(Jin, 1984).

Almost the same period, lot of mutations in the world were happened:

* Several marginal seas appeared(An, 1979);

* Obvious polar migration(Zhu Nei Shi Nan, 1933).

4.4. The fourth cycle

After broken up in Eogene, the China Plate began its new dynamical course once again.

4.4.1. The 1st Stage

The DPCS during Miocene Epoch (N_1) was SN, meaning to enter the 1st stage once more. Many great folds and compressive faults with strikes of EW were produced in Yinshan Mountain in this period(National Institute of Geology, Academia Sinica, 1980).

4.4.2. The 2nd - 4th Stages

The DPCS from Pliocene Epoch(N_2) to Pleistocene Epoch was from NW-SE to NWW-SEE, meaning from the 2nd stage to the 4th stage. A multiple grabens of NE strike formed in late Neocene were found in Huabei and Xialiao Plains(National Institute of Geology, Academia Sinica, 1980).

4.4.3. The 5th Stage

The DPCS during Holocene Epoch was nearly EW(Chen, 1979), meaning to enter the 5th stage once again, towards a new plate breakup.

Evidence: The North China Continental Margin Basin is experiencing a stretching mechanism caused by uplift activity of the upper mantle similar to the marginal sea(National Institute of Geology, Academia Sinica, 1980).

...

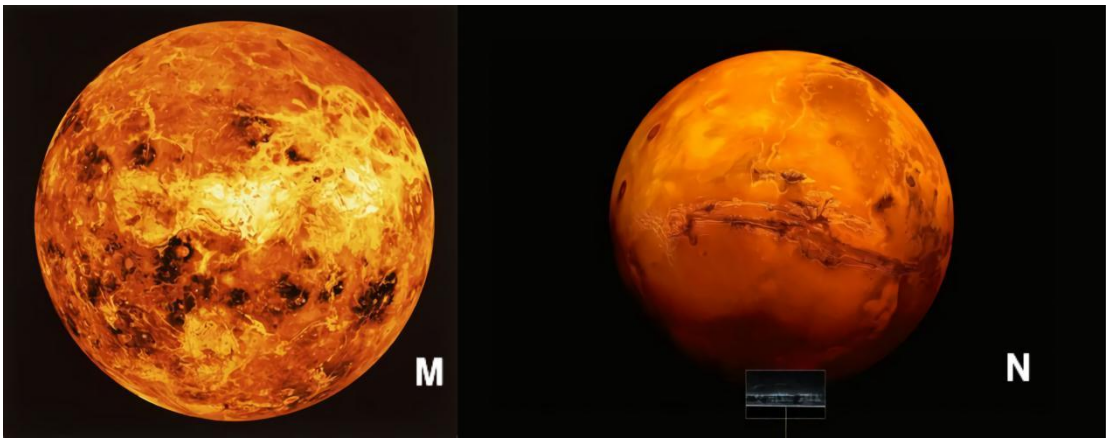
It is necessary to emphasize that there should be a premise for this model verification above: strikes of the palaeo- structures have been basically changeless.

Many scientists such as Wyllie, 1976 and Wang, 1982 have testified that polar movement locus of the North Asia from Precambrian to Quaternary drifted wholly northward in general, paralleled to Earth rotation axis; and there hasn't been any large change in palaeo-structures strikes. Therefore, it is believable to the analysis on palaeo- structure strikes above.

5. Key reason for the great differences between Earth and Mars/Venus

As the same rocky sphere, why do Mars and Venus not look as our Earth has entire plate breakup and subsequent a vivid biological world?

The key lies in, I think, our Earth is a three-axis ellipsoid just like a pear(Combined Diagram **1-A**), whereas Venus and Mars are standard spheres (Combined Diagram **4-M** and **N**).



Combined Diagram 4

M. Venus N. Mars

(Image: NASA)

When Venus or Mars rotates, its lithospheric plates are squeezed mainly by a north-south horizontal component of the resultant force of the longitudinal force and gravity, not the N5°E - S5°W horizontal component of the resultant force on our Earth(please see Section 2.3 and Table 3).

Just because the 5° deviation between Earth and Venus(or Mars) in the direction of the horizontal component of the resultant force that their lithospheric plates have gone through, respectively, many things that happened on Earth cannot be recreated on Venus or Mars.

Table 3. Five Stages in Plate Breakup on Venus or Mars

(in shape of standard sphere; take example by the eastern parts of its plates)

Stage	1	2	3	4	5
Direction of principal compressive stress	SN	NW - SE ~ EW Gradually deflecting 15°			
Strike of main shear plane		N40°E	N25°E	N10°E	N5°W (***not overlapping***) **(No 0° split)**

Based on Tianxi Sun (2021)

Here, on the plates within the Northern Hemisphere of Venus or Mars, the two sets of shear planes in its 4th stage would be N10°E and N10°W (please see Table 3). After again deflecting 15° towards the rotation axis, in its 5th stage, two sets of new shear planes of N5°W and N5°E (***not overlapping***) would appear. Therefore, the two sets of new shear planes in the 5th stage could not combine into one shear plane and entirely split of its lithospheric plates, as was done on our Earth (see Section 3.5.).

Hence, for Mars or Venus, none of these below can be produced: linear extremely strong 0° (N-S strike) shear rupture → linear entirely split of its lithospheric plates → mantle currents arched upward along linear breakup of plate → convection of hot

mantle → sea floor spreading → sea and ocean → continental drift → water and greenhouse gas → life and its evolution → Human beings ...

6. Conclusions

The following hypothesis has been proposed: the splitting of plates with SN strikes was just attributed to the maximum principle stress field accumulated by rotation of the Earth.

The course of the plate breakup would be as follows: any plate has to undergo 5 stages before breaking up; the 5 stages own each tectonic system; these 5 tectonic systems gradually deflect 15° towards the rotation axis of the Earth. After entering the 5th stage, the plate will normally be broken up; that is, one plate will be split into two plates.

Theoretically, the significance of this paper might be its filling in the gaps in the field of plate tectonics. The author has considered that plate tectonics would consist of three parts: continental drift, sea floor spreading and plate breakup. That is because without sea floor spreading there would be no continental drift; and also without plate breakup there would be no sea floor spreading. Therefore, it is of great significance to research the mechanism of plate breakup.

Moreover, the five-stage model may be able to explain as same rocky sphere why Mars or Venus do not look as our Earth has an entire plate breakup and subsequent

florid biological world: mainly because of the 5° deviation between Earth and Mars(or Venus) in the direction of resultant force that their lithospheric plates have gone through, respectively. The 5° deviation created our distinctive Earth and human beings. Throughout the Solar System, almost all planets are regular spheres except our Earth, which may be why humans is so lonely!

Declaration of Conflicts of Interest

I declare no conflict of interest.

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