Jan Koziar

Falsification of the Eulerian motions of lithospheric plates

Circularity of the plate tectonics theory

LAP LAMBERT Academic Publishing

Front cover:

The picture presents the non-closure of the Indian Ocean lithospheric plates which falsifies the assumed motions of the plates on a constant-size Earth. These are the Eulerian motions - fundamental for plate tectonics.

Instead the non-closure is one of Carey's artificial "gaping gores" which appear in reconstructions on a constant-size Earth. Such "gaping gores" are one of the proofs of the expanding Earth.

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On the 50th anniversary of plate tectonics

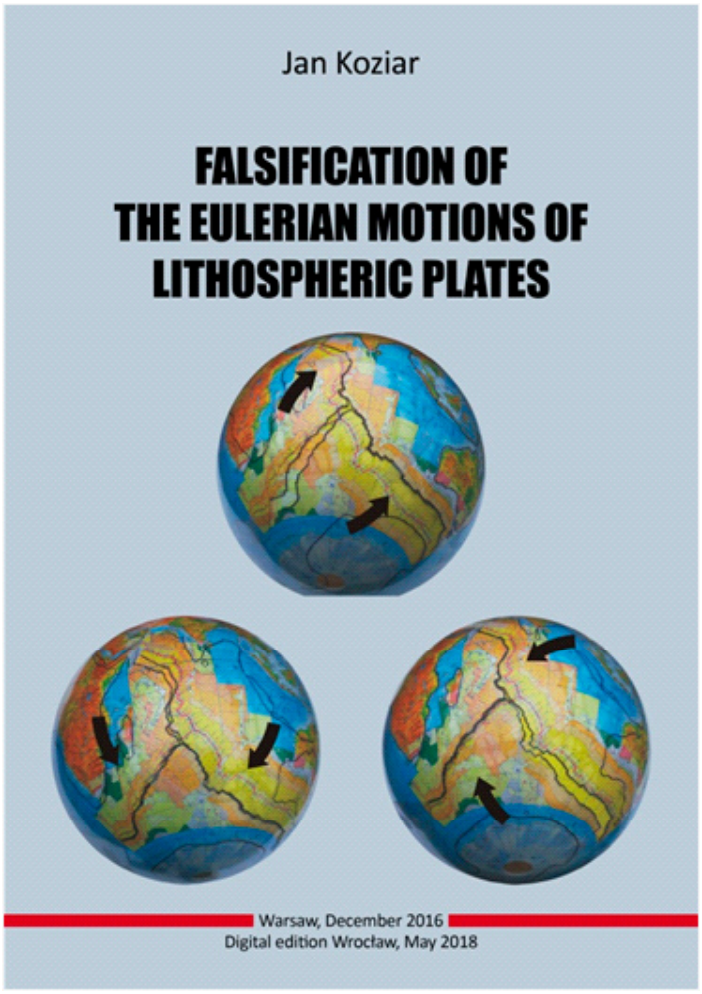
LAP LAMBERT Academic Publishing

English correction:
Steven Athearn
Graphics and text makeup:
Elżbieta Łysakowska

Foreword

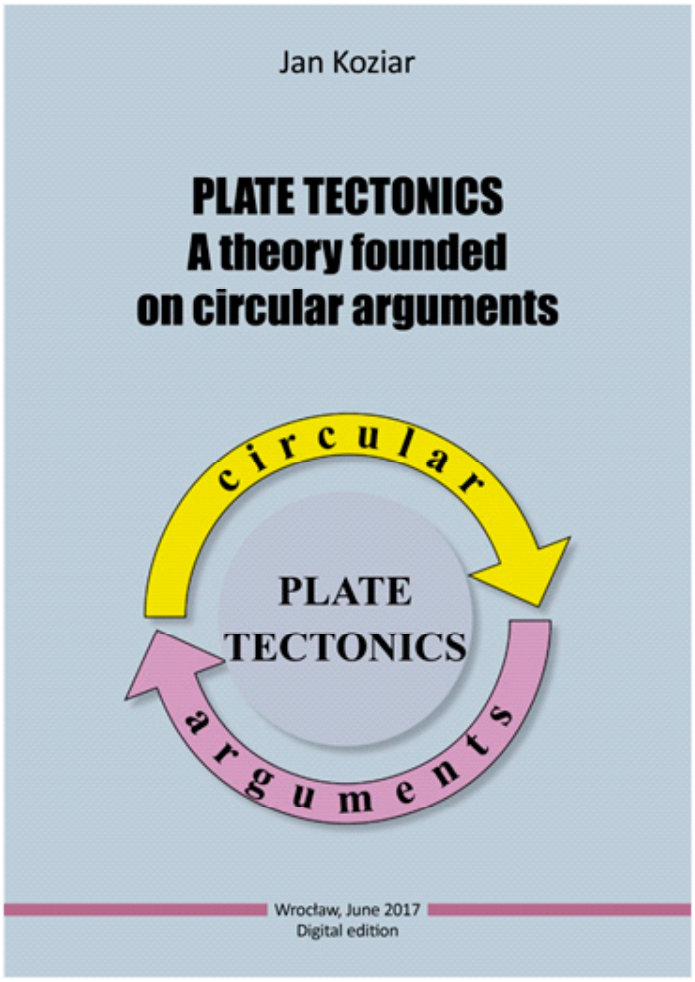
The book ***"Falsification of the Eulerian motions of lithospheric plates: Circularity of the plate tectonics theory"*** is founded on two papers. The first is ***"Falsification of the Eulerian motions of lithospheric plates"*** and the second ***"Plate tectonics: A theory founded on circular arguments"***.

The first paper is a conference one, following my lecture at the 3rd Polish Geological Congress held in Wrocław, 14-18 September 2016. The paper was reviewed and published in the Biuletyn Państwowego Instytutu Geologicznego (Bulletin of the National Geological Institute) no. 466, p. 147-178, 2016, DOI: 10.5604/01.3001.0009.4576. It is now available at www.wrocgeolab.pl/falsification2.pdf.



During elaboration of the paper as an Internet brochure I began to write a supplement to it. However the text appeared to be so voluminous that I

decided to publish it in the Internet as a separate brochure which is entitled just ***"Plate tectonics: A theory founded on circular arguments"***. It is available at www.wrocgeolab.pl/falsification3.pdf.



Now, a book more voluminous edition has given an opportunity to publish both papers together, according to my original intentions.

Because of such a fusion I left the references separately at each component of the book and also left independent numbering of figures in the second part of the book. In the first part all Polish-language accessories (included in the publication by the Bulletin of the National Geological Institute) were removed.

Jan Koziar
May 2018

Acknowledgements:

I would like to thank the Lambert Academic Publishing for publication of this book, Elżbieta Łysakowska for its graphics and text makeup and Steven Athearn for English correction of its both parts.

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Part One

Falsification of the Eulerian motion of lithospheric plates

Abstract: *Morgan (1968) tested the supposed Eulerian motion of lithospheric plates by calculation on a circuit around the Indian Ocean triple junction. The present analysis performed on a physical model shows that on a non-expanding Earth, the reconstructed Southwest Indian Ocean Ridge fails to close as it should according to the allegedly positive result of Morgan's test, which is thereby shown to be in error.*

Wedge-shaped openings, appearing along all arms of the Indian Ocean triple junction during its reconstruction, are examples of Carey's artifactual "gaping gores" which in general are one of the proofs of the Earth's expansion. A global plan of plate motions based on the Eulerian principle is impossible and confirms Carey's Arctic Paradox which is other proof of the expansion of the Earth. Space geodesy testing of expanding Earth is in fact testing of possible expansion of the plate tectonics model, not the real Earth. V-shaped openings between plates, when real, are not of Eulerian origin but are large sphenochasms in Carey's sense caused by an expanding interior of the Earth.

Key words: *Morgan's test, Indian Ocean triple junction, gaping gores, diffuse plate boundaries, plate tectonics absolute reference frames, Carey's Arctic Paradox, sphenochasms, Earth expansion.*

1. Introduction

Supposed Eulerian motions of lithospheric plates are the essential basis of the plate tectonics paradigm. This type of motions is falsified in this paper. The right alternative is exclusively divergent non-Eulerian motions of plates, driven by significant expansion of the Earth interior. On an expanding Earth the stretched sublithospheric mantle directly drives the plates and provides an absolute reference frame for the description of their motion. In the plate tectonics paradigm, both driving mechanism and absolute reference frame are elusive.

2. Supposed Eulerian motions of lithospheric plates

According to Euler's theorem any relative movement of two elements on a sphere is equivalent to a rotation around an axis (Euler's axis) crossing the centre of the sphere. The points where the axis crosses the sphere are called poles of rotation (Fig. 1).

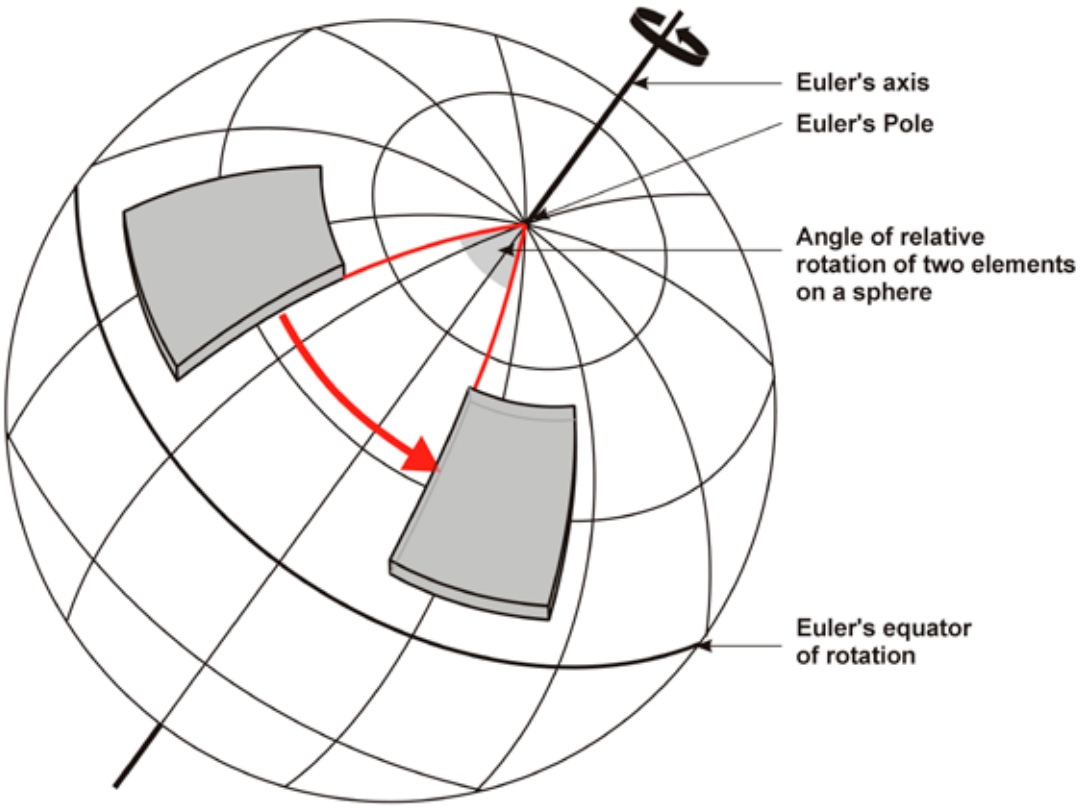


Fig. 1. *Axis and pole of relative rotation of two elements on a sphere (after Kearey &Vine, 1996)*

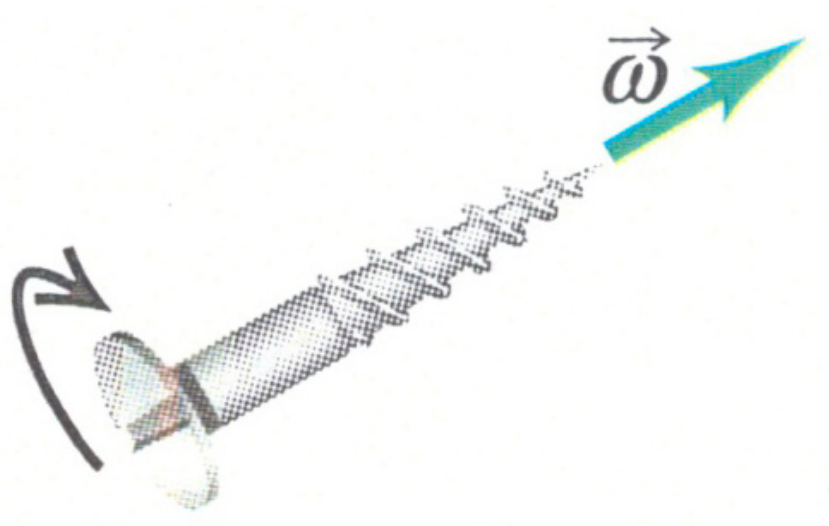


Fig. 2. *Dextrorotatory-screw rule determining the sense of vector of angular velocity*

The Euler theorem was first used in geotectonics by Bullard *et al.* (1965) as a basis of their reconstruction of the Atlantic Ocean.

Euler's purely geometrical theorem was extended to today's plate tectonic kinematics by Jason Morgan in his lecture delivered on April 17, 1967 at the AGU meeting and later in a paper published in April 1968. And though McKenzie and Parker published earlier a similar paper (December 1967) Morgan has a priority in formulating kinematic rules of plate tectonics. The extension of Euler's theorem is as follows in accordance with rotation rules of rigid body.

When a relative angular speed (ω) of two plates is known we can represent it by a vector collinear with the Euler axis. The length of the vector corresponds to the scalar quantity of the relative angular speed. The sense of this vector, bound with the relative movement of the plates, is determined by the dextrorotatory screw rule (Fig. 2).

Such vector of angular velocity $\boldsymbol{\omega}$ (this time in bold) fully describes the relative kinematics of the two plates. Such a vector is called by plate tectonicists an "Euler vector" but Euler did not engage so far in the problem and so it should perhaps be called a "Morgan vector". In spite of this I will use the previous conventional term.

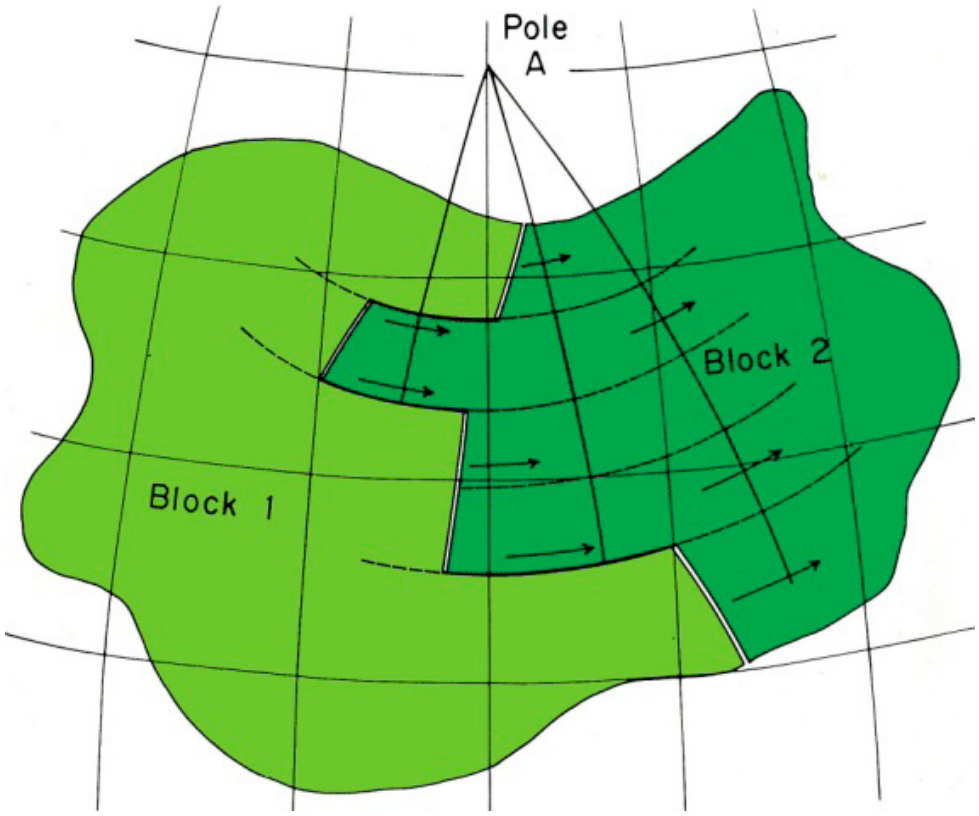
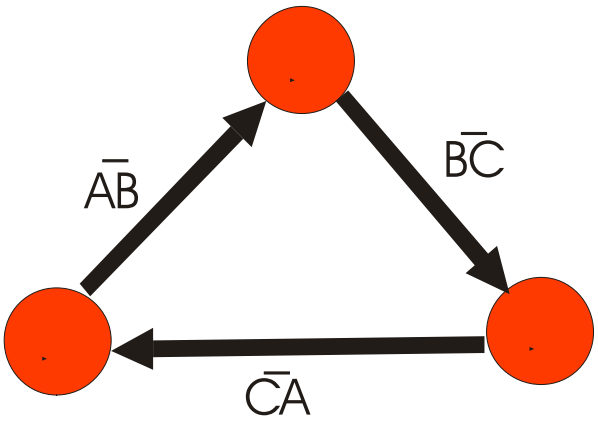


Fig. 3. *Pole of rotation determined as an intersection point of great circles perpendicular to transform faults (after Morgan, 1968)*



$$\bar{AB} + \bar{BC} + \bar{CA} = \bar{0}$$

Fig. 4. *Circuit built of three vectors of relative angular speeds of three plates (explanation in text)*

Morgan found poles of relative rotation of two plates as intersection points of great circles perpendicular to transform faults between the plates (Fig. 3). In practice these points are very scattered and determine only a fairly large region in which the pole of rotation should be. The areas are marked on maps by quite large 95% confidence ellipses, the centres of which are treated as Euler poles and used in "precise" calculations.

Morgan calculated a relative angular velocity of the plates from the spreading rates between them. This means that Euler vectors can be directly determined only for divergent plate boundaries, *i.e.* only for plates situated on both sides of oceanic ridges.

However, Euler vectors can be added or subtracted according to the general rules of vectorial calculus and in this way other vectors of relative plate movement, which cannot be measured directly, can be calculated.

An important property of this calculus is that a sum of vectors along a closed circuit of vectors is equal to zero. The smallest closed circuit is composed of three vectors (Fig. 4). In plate tectonics it corresponds to three plates joined together at a so-called "triple junction". If any element of the sum is unknown it can be transferred to right side of the equation and calculated as the sum of the remaining vectors. The same is true in circuits composed of more than three vectors.

If the sum in a closed circuit is different from zero it means that something is wrong.

Morgan used this formal opportunity to prove that Eulerian motions of the plates (*i.e.* their supposed gliding on a constant-size Earth) is correct.

He and his successors believed that the result of his test was positive and on that basis constructed the whole ω-space (the term by McKenzie and Parker, 1974) in which they forced the geotectonics and geology as well.

It will be shown below that the result of the Morgan test was wrong.

3. Morgan's test of the Eulerian motions of plates

Morgan (Morgan, 1968) presented his test of the Eulerian motions of the plates in a section entitled: *„The motion of the Antarctica block relative to the African block"*. He was able to determine Euler vectors for three pairs of plates:

1. Antarctic and Pacific,
2. Pacific and North American,
3. North American and African.

It was difficult to determine the spreading rate for the African and Antarctic plates and Morgan calculated it by summing up the vectors mentioned above along a circuit which can be called "Morgan's great circuit" – Fig. 5A. He obtained the value of 1.5 cm/year.

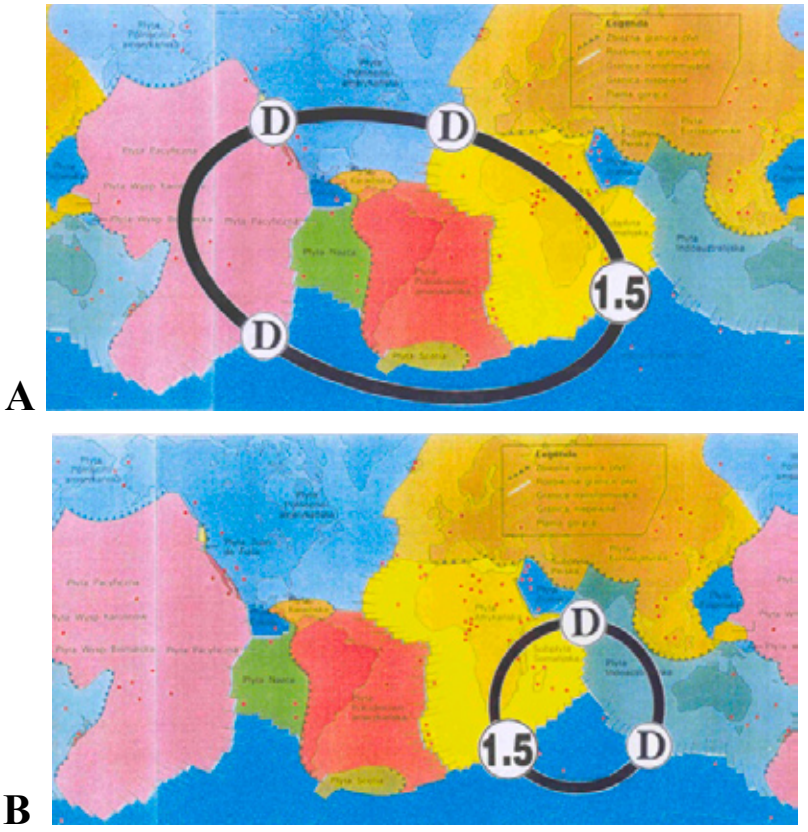


Fig. 5. *Structure of Morgan's test,* **A** *– Morgan's great circuit,* **B** *– Morgan's small circuit,* **D** *– data (measured spreading rate), 1.5 – calculated spreading rate (cm/year). The schemes are made by the present author. Detailed explanation in text*

Then he tried to confirm this result by an independent calculation along another circuit, around the Indian Ocean triple junction, which can be called "Morgan's small circuit" or "Morgan's testing circuit" (Fig. 5B). The result was apparently (see text below) also 1.5 cm/year which was treated as a proof of the Eulerian movement of the plates on a non-expanding Earth.

However, a proof of such a great significance should be based on at least a few similar confirmations to avoid the possibility it is merely accidental. Doubts are the more justified because the second Morgan calculation was not made precisely on his vectors but in a "more or less" way (!) as can be seen below:

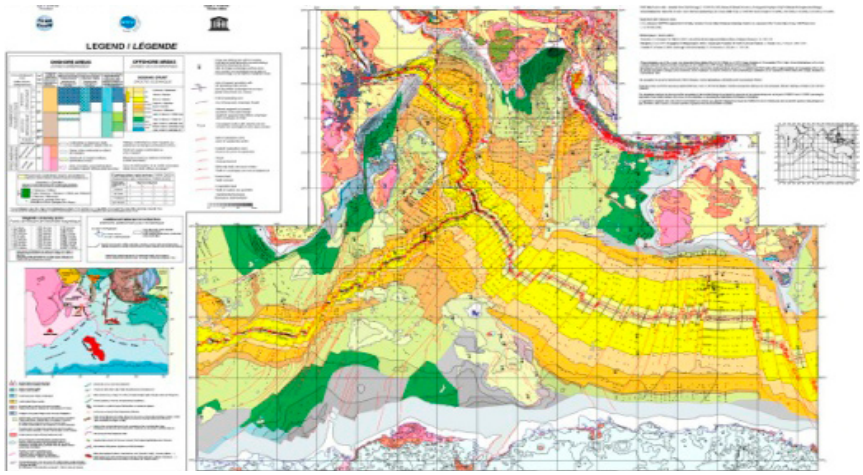
> *The mid–Indian Ocean rise between Antarctica and Australia is opening north to south at a rate of about 3.0 cm/yr (Le Pichon, 1968), and the Carlsberg ridge is opening* ***more or less*** *[bold by J.K.] north to south at a rate of about 1.5 cm/yr. The difference between these rates agrees with the value of 1.5 cm/yr listed in Table 8–5.* (Morgan, 1968; p. 1982).

The „*value of 1.5 cm/yr listed in Table 8-5*" is the value seen in Fig. 5A.

4. South-west gaping gore in the Indian Ocean triple junction falsifies apparent positive result of Morgan's test

The falsification was carried out by the author of the present paper on a physical model comprising a geographical globe on which the geological structure of the Indian Ocean has been superposed, and transparent plastic spherical caps imitating lithospheric plates.

The map used for this purpose was the Structural Map of the Indian Ocean by Ségoufin *et al.* (2004); Fig. 6A, taken from the Internet. The map was digitally segmented into suitable strips (Fig. 6B) and the strips were digitally transformed into globe's wedges or peels (Fig. 6C). Then the wedges were printed on a self-adhesive paper and pasted onto the geographical globe (Fig. 6D).



A

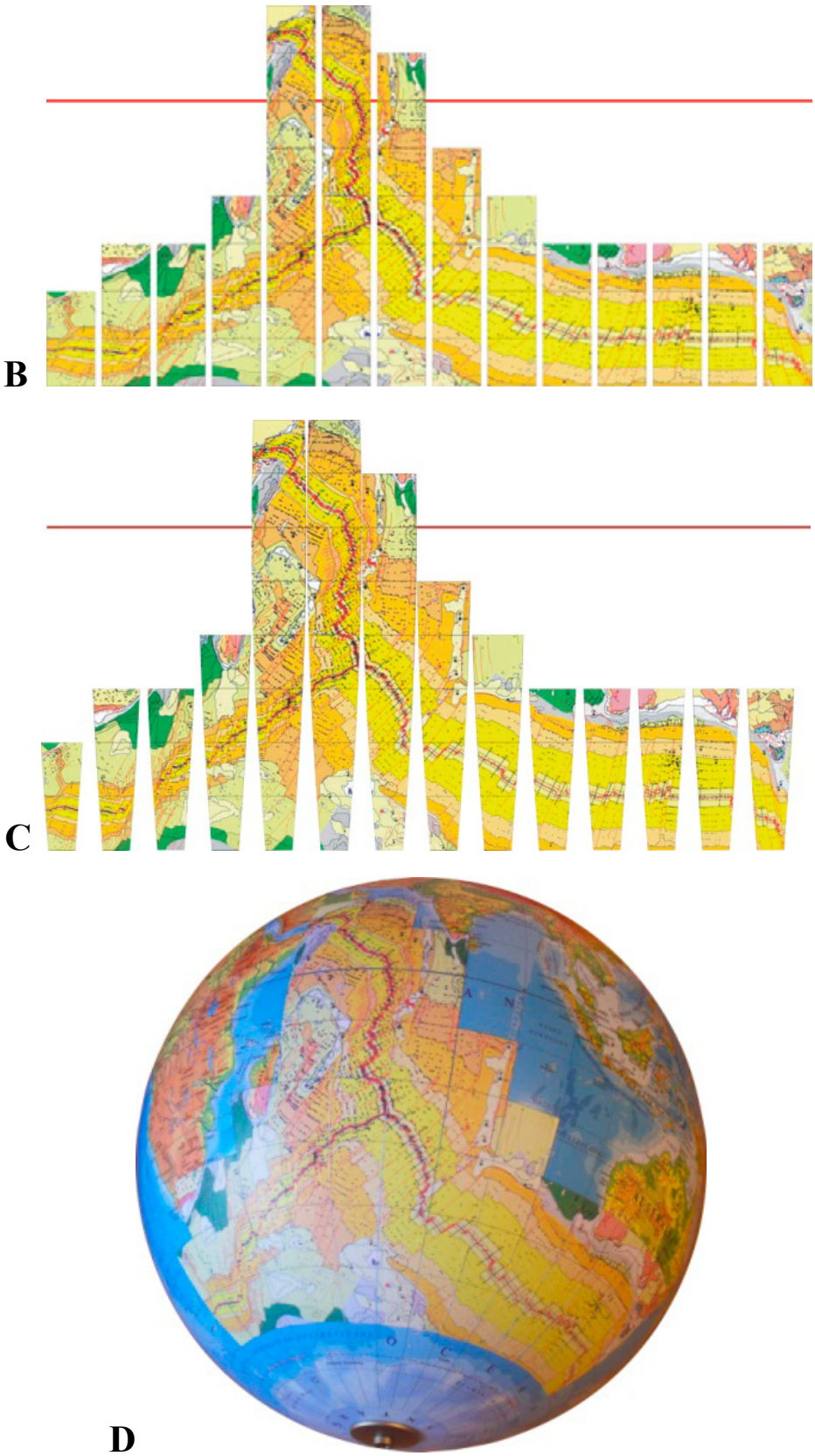
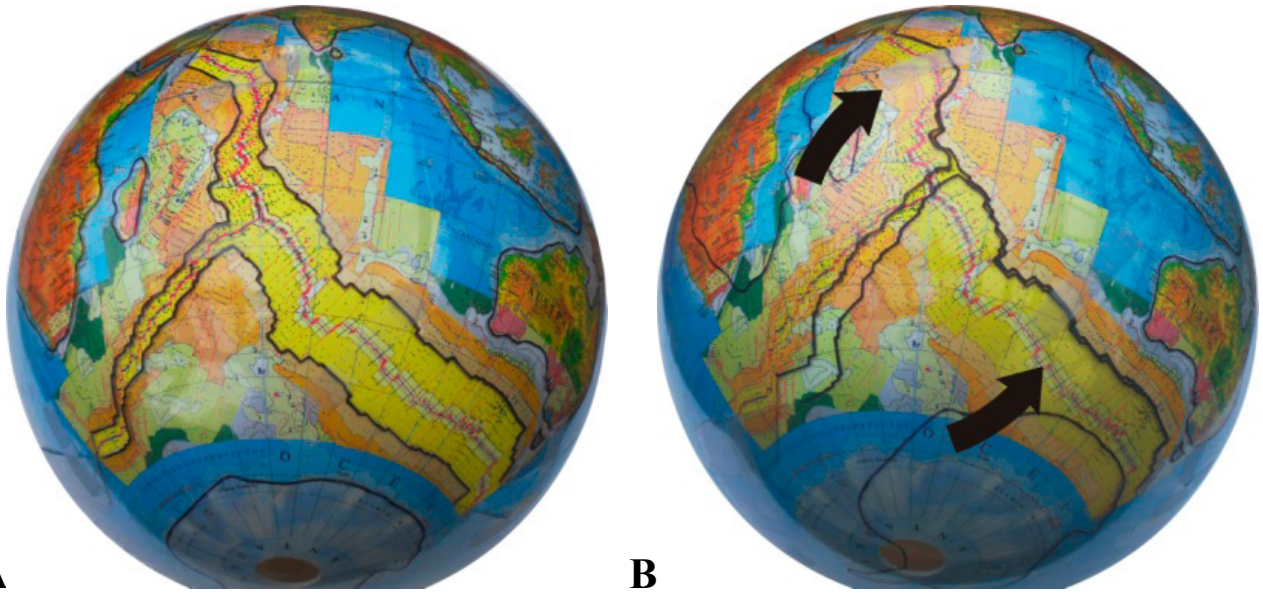


Fig. 6. *Procedure of putting the Structural Map of the Indian Ocean on a globe (explanation in text)*

After that three plates: the African, Antarctic and Indo-Australian were cut from the plastic caps. The cutting was made along the 20 Ma isochrones (turn of the Paleogene/Neogene) that define their common boundary as it

was at the time. These old borders were colored in black. Then, the plates were put on the globe in their present positions (Fig. 7A).



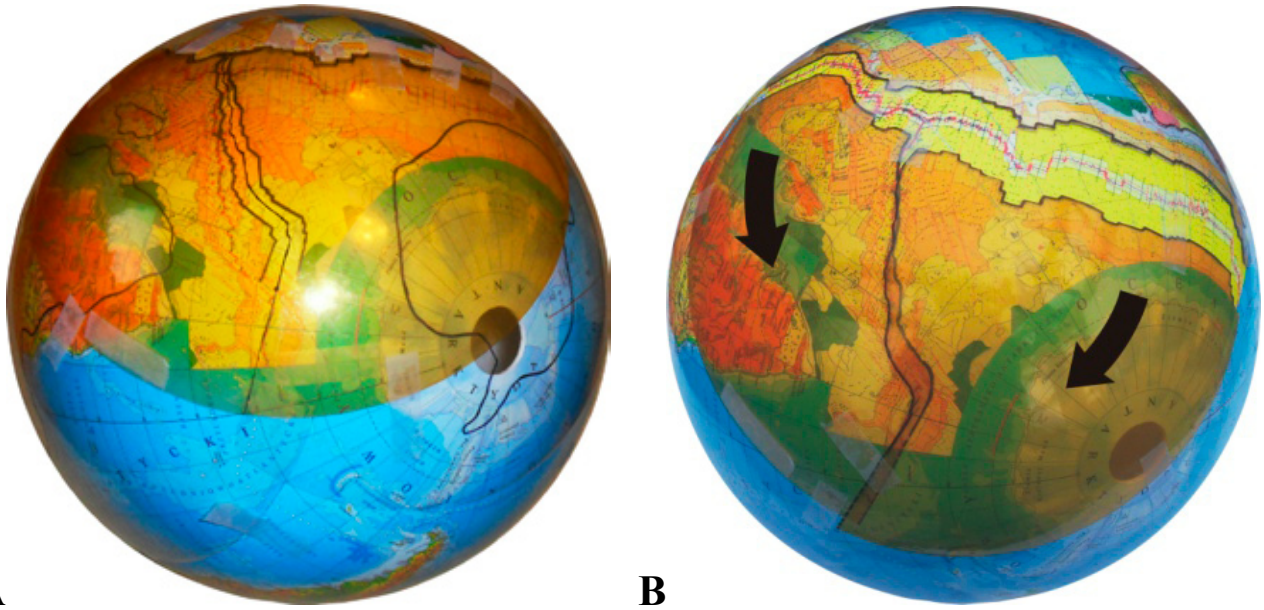
A **B**

Fig. *7. Appearance of an artificial gaping gore between the African and Antarctic plates on a non-expanding Earth (explanation in text)*

After that the African and Antarctic plates were pushed into position against to the Indo-Australian one, along the transform faults (Fig. 7B) in order to restore the relative position of all three plates before 20 Ma.

The significance of the gaping gore is that this opening comes about when reversing the real spreading history along the boundary between these two plates and the Indo-Australian one. Consequently, the real spreading along the latter boundary should imply that the border between Africa and Antarctica is a convergent one, whereas in fact this border is also divergent. We can also model the specific form of the implied (counterfactual) convergence with the use of plastic caps.

Natura horret vacuum. The empty space of the gaping gore is impossible and so older oceanic lithosphere should have been present there. The 20 Ma boundary between the African and Antarctic plates in this lithosphere can be represented by a line bisecting the gaping gore in Fig. 7B. Thus, a less-transparent plastic cap was placed over the previous plates and the bisecting line drawn on it (Fig. 8A). The cap was then cut apart along this bisecting line. Next, the now-separated plates were moved into alignment with the present location of the -20 Ma isochrones to their NE (Fig. 8B).



A B

Fig. 8. *Artificial convergence between the African and Antarctic plates on a non-expanding Earth (explanation in text)*

Since this movement represents the real movement of the plates (forward in time) general divergence along the common boundary of the two plates should be found. But in fact the mutual border of the two plates is divergent only in a small initial section near the triple junction. Beyond the longitude of Madagascar, the two plates converge (overlap). What is more, the divergence in the small eastern section is much smaller than their real divergence.

These relationships show that the Euler pole for the two plates lies near the triple junction and the rate on the equatorial plane perpendicular to the Euler axis (and on the southwest side of the Euler pole) is negative. Thus, along the Southwest Indian Ocean Ridge there should be subduction not spreading. Something is here evidently wrong.

If Morgan had performed a correct vectorial calculation along his small circle (Fig. 5B) he should have obtained negative relative velocity on the African – Antarctic Ridge instead of his positive value of 1.5 cm/year. So, his result obtained in the "more or less" way is not only quantitatively but also qualitatively wrong.

Because the Southwest Indian Ridge is in fact divergent it means, in plate tectonic's language, that the Indian Ocean triple junction circuit is not closed. This was found later by plate tectonicists, and their way of treating the problem will be discussed in subsequent sections.

5. Carey's "gaping gores" as a proof of the expansion of the Earth

The term "gaping gore", used in the previous section, is exactly the same that was used by Carey to denote artificial wedge-shaped gaps, appearing on reconstructions which neglect the greater curvature of the Earth's surface in the past (smaller radius of the ancient Earth). The name of these artefacts was introduced by him in 1976 (Carey, 1976) but the problem had already been described in 1958 (Carey, 1958). It led Carey, after strenuous attempts at better assembling of Wegener's Pangaea on a non-expanding Earth, to understanding the expansion of the Earth (see subsection "Tethys zone gaping gores").

In more formal language "gaping gores" may be called "openings of an underestimated curvature".

Existence of the artificial gaping gores is one of the proofs of the Earth's expansion.

a. South Atlantic gaping gores

A good example of gaping gores are the ones (noticed already by Carey) appearing attempting to assemble South America with Africa. When the southern borders of both continents are put together the Guinea Basin's gaping gore appears (Fig. 9A). When the northern borders are put together, the Cape Basin's gaping gore appears (Fig. 9B).

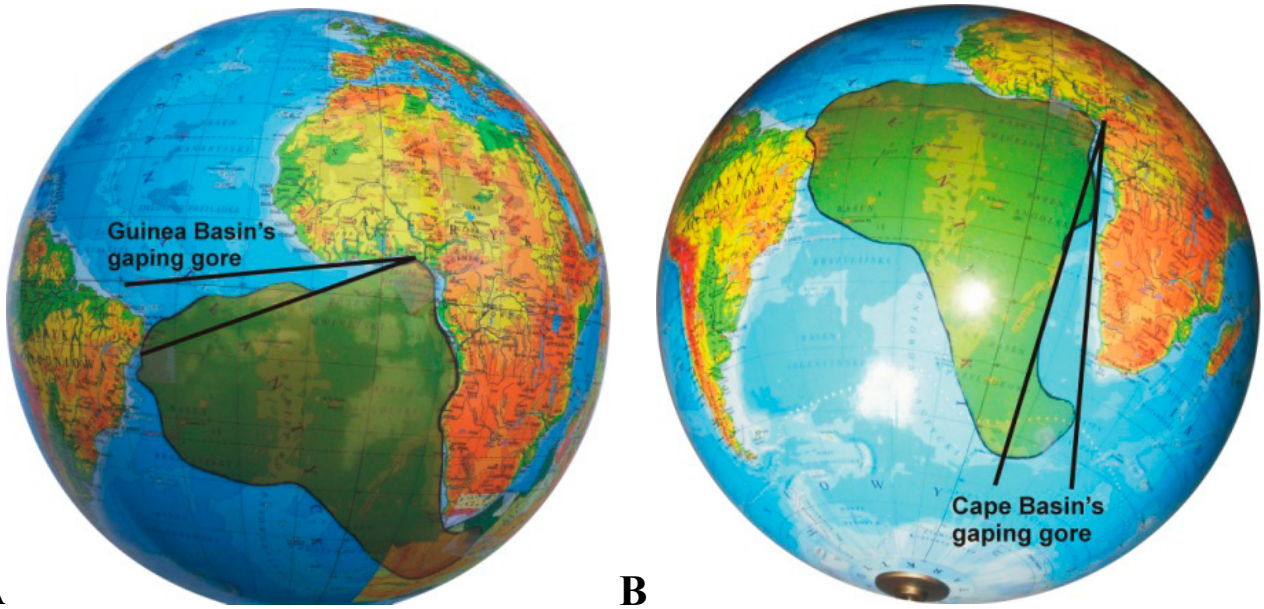


Fig. 9. *Gaping gores on a non-expanding Earth,* **A** *– Guinea Basin's gaping gore,* **B** *– Cape basin's gaping gore (explanation in text)*

Both South Atlantic artificial gaping gores disappear on Maxlow's proper reconstructions made on an expanding Earth (Fig. 10).

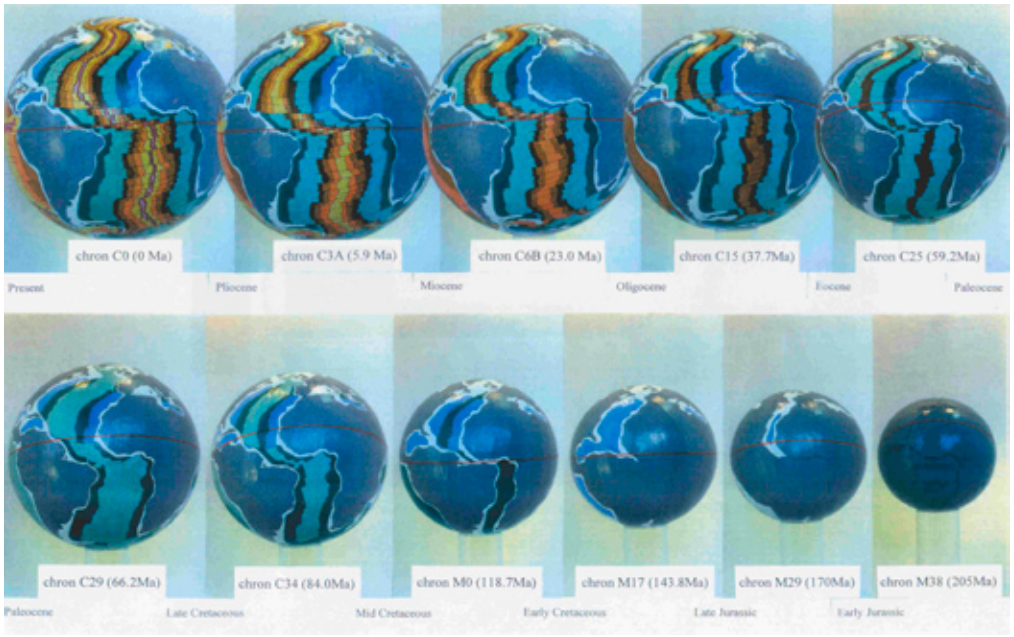


Fig. 10. *Maxlow's (1995) reconstruction of the Atlantic Ocean on the expanding Earth without gaping gores*

b. South-west Pacific gaping gores

Another example of gaping gores are those appearing along the southwest Pacific rise (my findings). My big geotectonic globe of 85 cm in diameter (scale 1:15 mln), made from Russian geological globe strips and magnetic linear anomalies from about 300 papers (Fig. 11), will be used for their demonstration.

Fig. 11. *My big geotectonic globe (85 cm in diameter) watched by professor Cliff Ollier. Construction of this item of the globe was sponsored by the Polish industrial group KGHM POLSKA MIEDŹ. The photo was taken in Geological Museum of Institute of Geological Sciences of Wrocław University*

The Southwest Pacific rise and its geotectonic vicinity are presented in Fig. 12A. The Paleogene-Neogene border is marked there by a light-brown line. Adjacent parts of the Pacific and Antarctic plates were cut along these boundaries from opaque plastic caps. After putting them on the globe in accordance with the present structures, they imitate the old Pacific and Antarctic plate fragments from before 20 Ma, in their present position (Fig. 12B).

After juxtaposition of this old Antarctic plate with the Pacific one along the NE part of their common border, a gaping gore appears in their SW part of the border (Fig. 12C). This artificial gap can be called the "Balleny Islands gaping gore".

Then, after juxtaposition of the old Antarctic plate with the Pacific one along the southwest part of their common border, a gaping gore appears in their northeast part of the border (Fig. 12D). This artificial gap can be called the "Easter Island gaping gore".

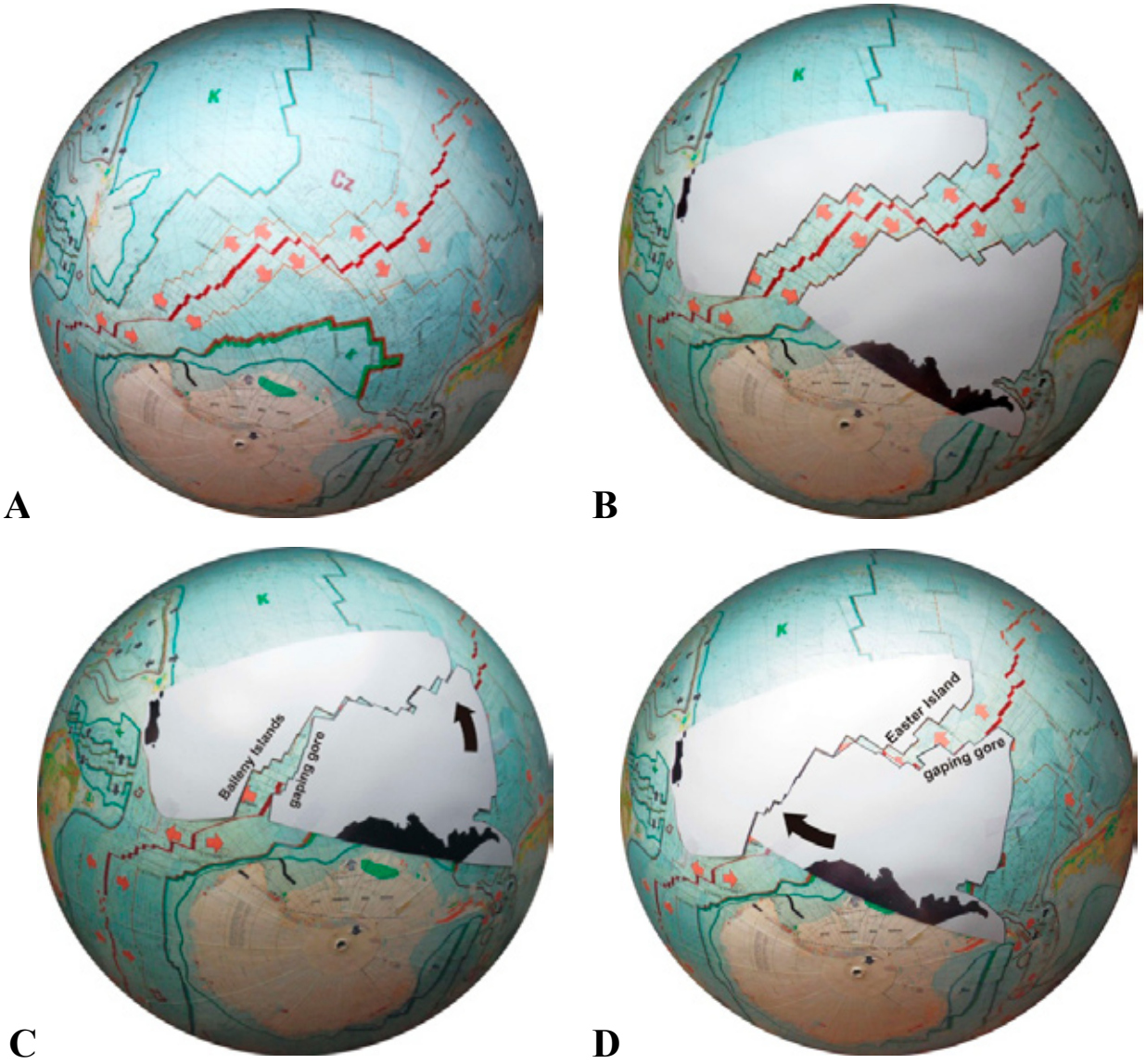


Fig. 12. *Gaping gores in the southwest Pacific (explanation in text)*

Both gaping gores disappear on a smaller Earth reduced by the 20 Ma (post-Paleogene) increment in oceanic lithosphere. This is accomplished by Maxlow's reconstructions (Fig. 13).

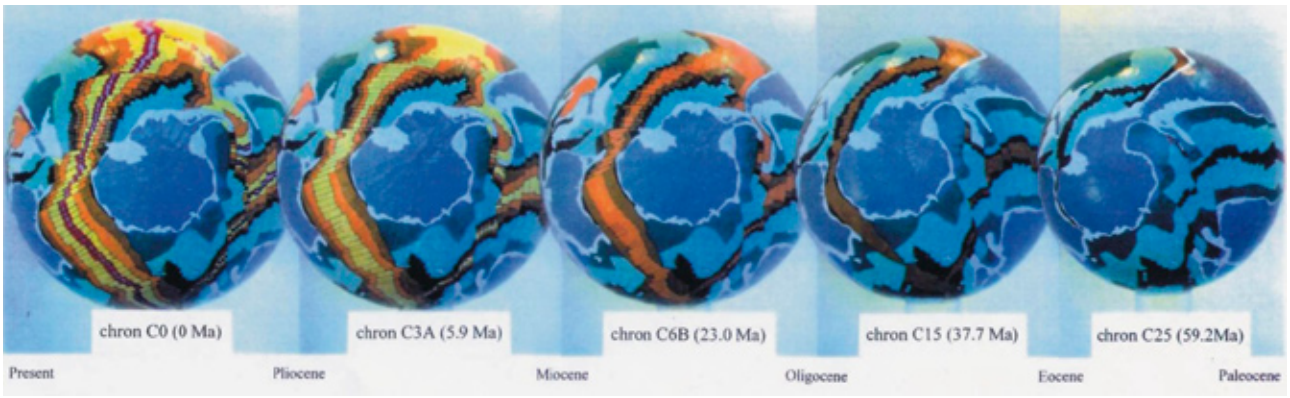


Fig. 13. *Maxlow's (1995) reconstruction of Antarctic region on the expanding Earth without gaping gores on the southwest section of the Pacific Rise*

c. Tethys zone gaping gores

Deeper in the past, the Earth's surface curvature was greater and so the gaping gores are also greater. The biggest gaping gore is, the artificial Tethys Sea gaping to the East on the Dietz and Holden (1970) reconstruction (Fig. 14A).

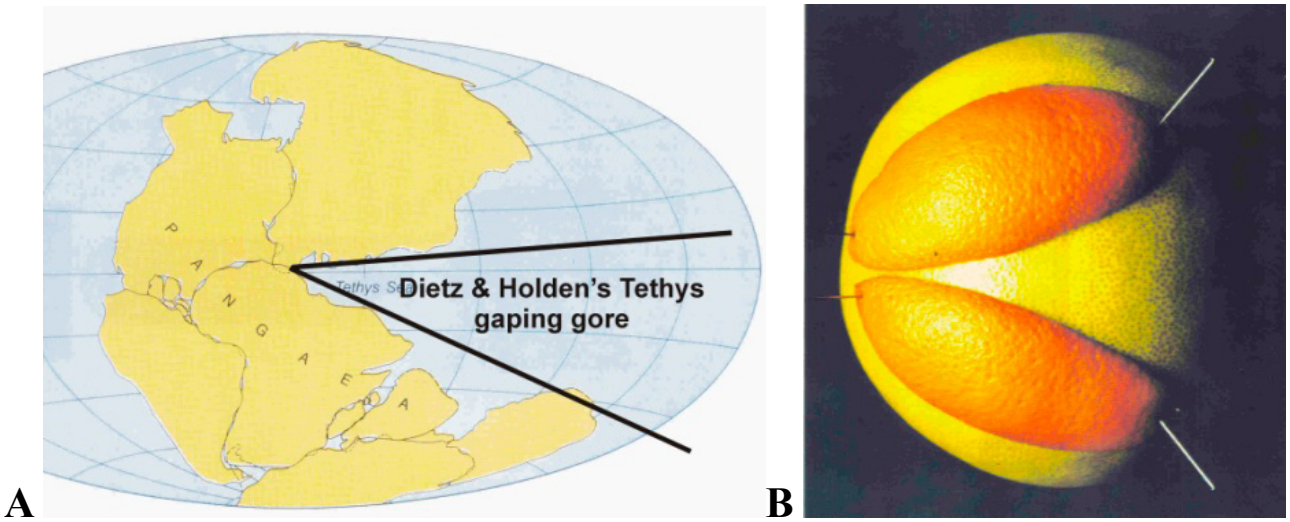


Fig. 14. **A** *– Dietz & Holden's Tethys gaping gore,* **B** *– explanation of Dietz and Holden's Tethys gaping gore by Van Hilten's orange peel effect – own model (explanation in text)*

This phenomenon can be also described by Van Hilten's (1963) "orange peel effect" which consists in the appearance of gaping gores when attempting to put together an orange peel on a bigger sphere (grapefruit) than the orange from which it came (Fig. 14B).

Another example of this kind, but more balanced, are the two Tethys gaping gores (Fig. 15A) in Du Toit's (1937) Pangaea. An analogous orange peel model is given in Fig. 15B.

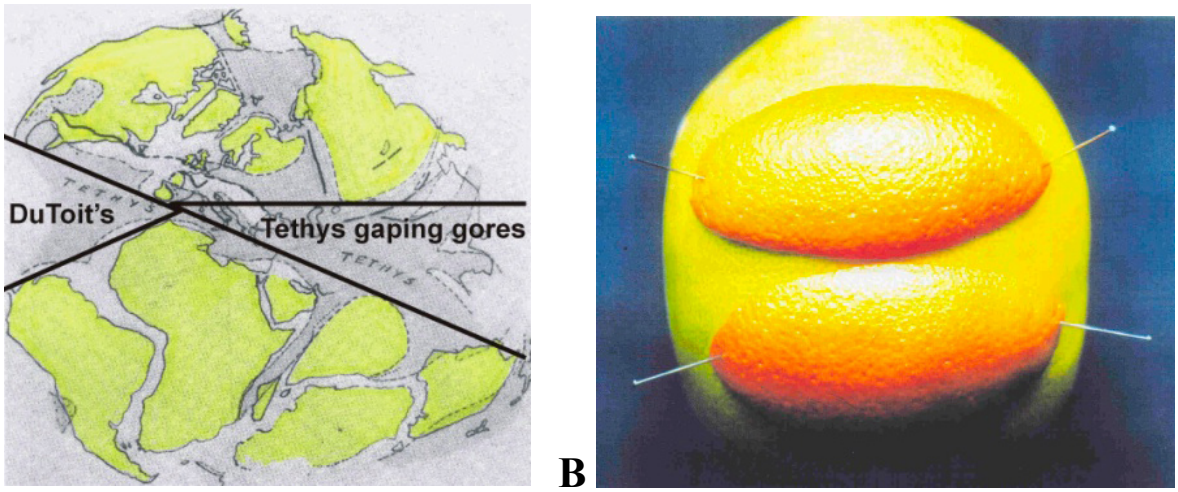


Fig. 15. **A** *– Du Toit's Thetys gaping gores,* **B** *– explanation of Du Toit's Thetys gaping gores by Van Hilten's orange peel effect (own model)*

The orange peel in Fig. 14B can also be reunited in the opposite way (Fig. 16A) and in the same way can be reunited Gondwana and Laurasia (Fig. 16B).

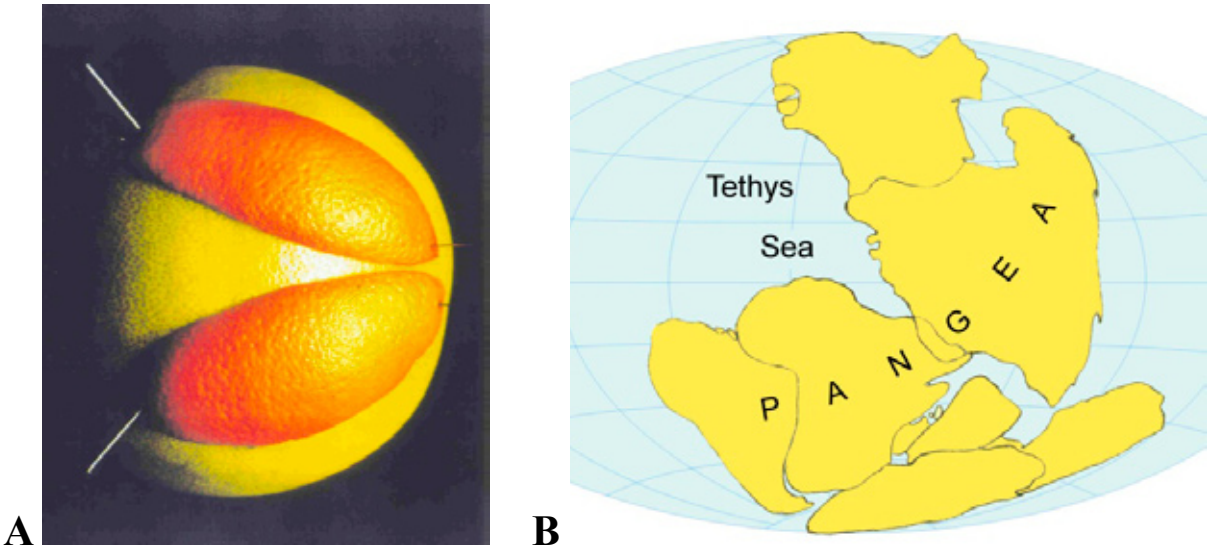


Fig. 16. **A** *– another possible arrangement of orange peels in style presented in Fig. 14,* **B** *– extreme West Tethys "Ocean" gaping gore (my figures)*

Carey, as an Australian geologist, was better aware of the Paleozoic connection of Australia with south-east Asia than western geologists. He reported (Carey, 1988, p. 158-159) that when he tried to connect Gondwana with Laurasia in the East, a big gaping gore appeared in the West, just as in Fig. 16B. Let us to quote:

> *Confident that the gap [in the East –JK] was false, I started a reconstruction of Pangaea from Australia-Indonesia without any gap, but*

as I proceeded to assemble the other continents, a new gap appeared, widening to 50 degrees, between the Americas, which was also false. Whatever I tried, I always ended with a gaping gore from about the middle of the assembly to a 50-degree gap at the periphery, opposite where I had started. Finally, after months of frustration and anguish, I realized that my troubles arose because I was trying to reassemble Pangaea on a spherical table the same size as my globe, whereas I should have been using a table of smaller radius, because the earth had expanded significantly since the time of Pangaea. I was trying to button a waste-coat over an enlarged belly! Every seamstress knows to insert a tapering gore into a skirt to increase the flare. I had been working on continental drift for a quarter of century, taking it for granted that the Earth's radius was constant.

d. Wegener's improper avoidance of Tethys zone gaping gores

One can wonder how Wegener was able to make his Pangaea without any gaping gores. He was able to do it by extreme stretching of the peripheral areas of his supercontinent. I have transferred Wegener's (1929) Pangaea onto an equal-area hemispheric net (Fig. 17).

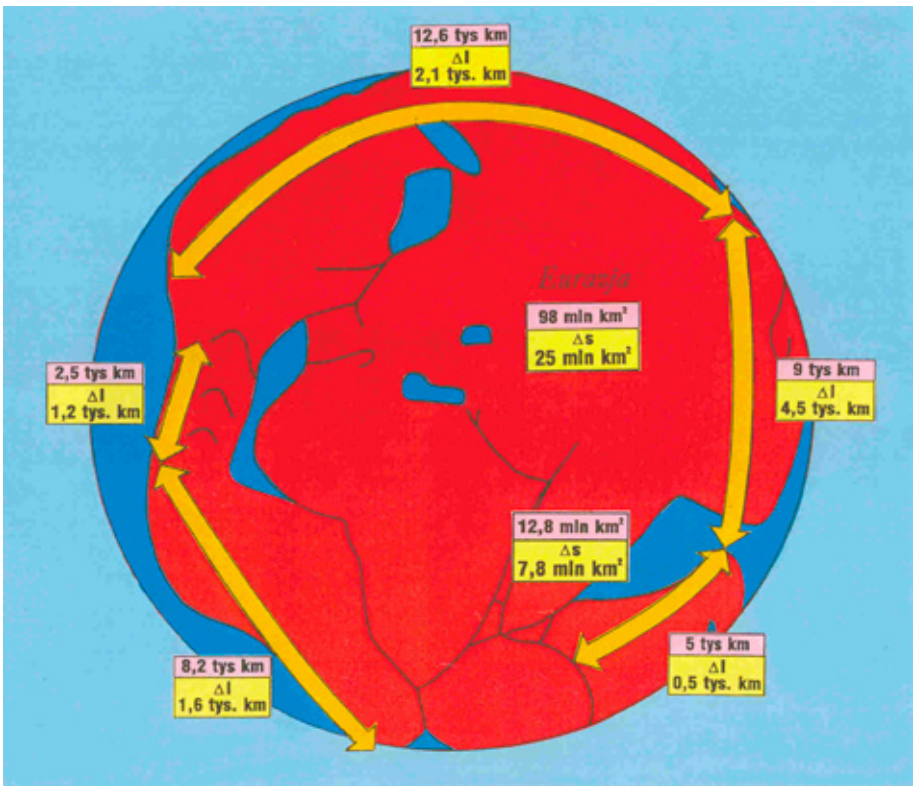


Fig. 17. *Artificial stretching of the peripheral parts of Wegener's Pangaea. In the upper parts of the frames there are Wegener's values for distances and areas. In the lower parts are increments of Wegener's values above the real values*

Surface areas of the continents were measured by a planimeter. Peripheral distances were measured by transferring their end points onto a geographical globe (using their geographical coordinates) and measuring there the distances by means of a string. The results are given in Fig. 17 and Table I.

Table I. Wegener's increment of peripheral distances in his Pangaea

Section	Distance		Wegener's increment [10^3 km]
	Real [10^3 km]	Wegener's [10^3 km]	
Australia	4.5	5.0	0.5
East Asia	4.5	9.0	4.5
North Laurasia	10.5	12.6	2.1
Central America	1.3	2.5	1.2
South America	6.6	8.2	1.6

As is seen, all the peripheral distances are stretched – East Asia and Central America even doubled. There are no geological evidences of their subsequent contraction during dispersion of Wegener's Pangaea. Just the opposite, they were stretched during dispersion, especially Central America.

The same is true with surface areas of Eurasia and India in Wegener's Pangaea as is seen from Fig. 17 and Table II.

Table II. Wegener's increment in areas of Eurasia and India

Region	Area [10^6 km^2]		Wegener's increment [10^6 km^2]
	Real	Wegener's	
Eurasia	73.0	98.0	25.0
India	5.0	12.8	7.8

As is seen, India is inflated in Wegener's reconstruction over 2.5 times.

Wegener gradually diminished the artificially inflated peripheral regions of his Pangaea during its dispersion. In this way he was able to disperse them despite Meservey's (1969) topological objection that Pangaea occupying one hemisphere cannot disperse on a non-expanding Earth. It is immediately jammed on its perimeter.

The properties of Wegener's Pangaea given above can be presented visually on the following model (Fig. 18):

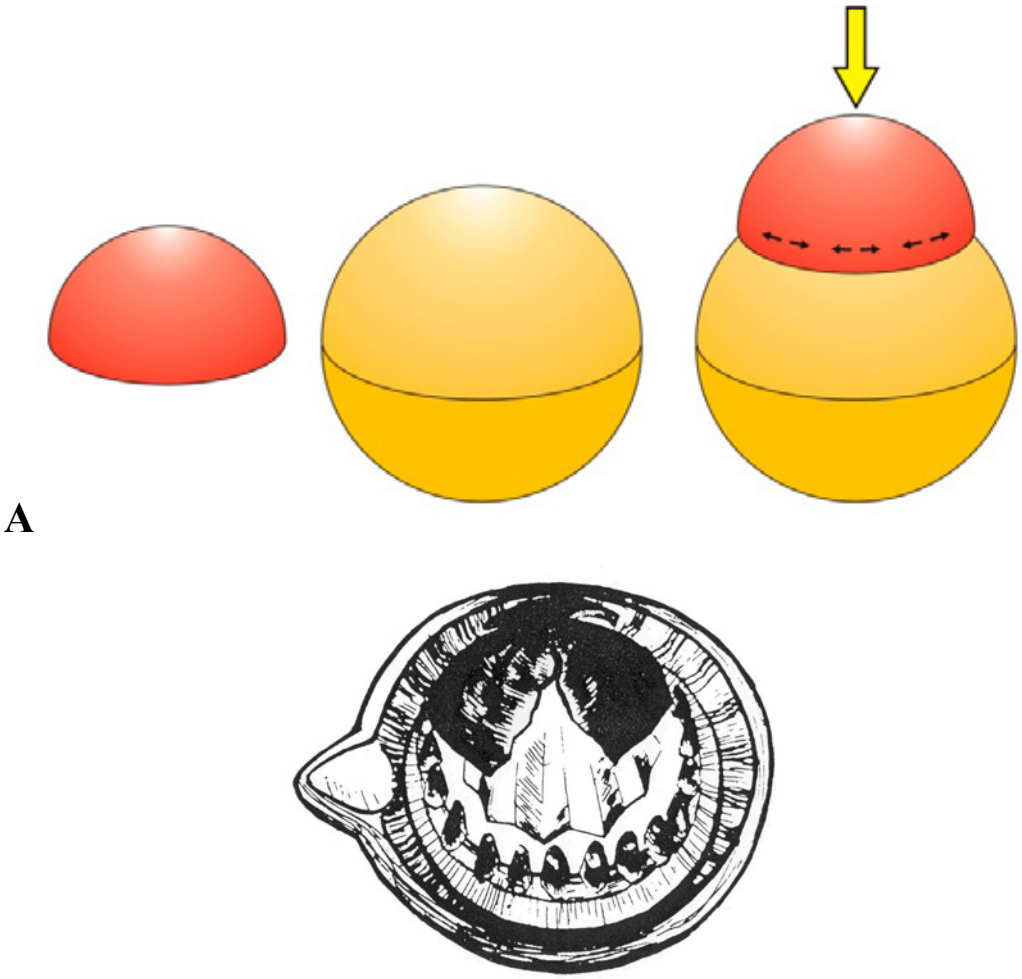


Fig. 18. **A** *– own model illustrating artificial stretching of the peripheral parts of Wegener's Pangaea (explanation in the text),* **B** *– Carey's model illustrating the origin of artificial Tethys "Ocean" as an extreme gaping gore (explanation in the text)*

Let us put a small bowl (red) on a bigger sphere (yellow). When we press on the bowl in order to match it to the bigger sphere, the peripheral parts of the bowl will be stretched, just as in Wegener's Pangaea.

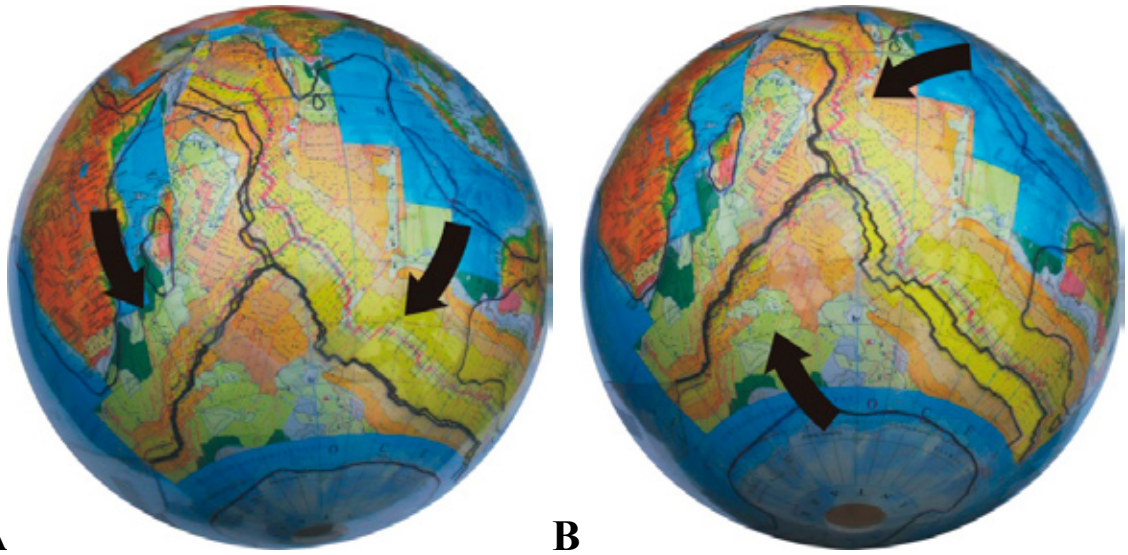
If the bowl does not resist the pressure and is torn, a gaping gore will appear (Fig. 18B). This Carey (1976) model exhibits properties of Pangaeas of Wegener's successors who prefer the latter type of solution.

6. Remaining gaping gores in Morgan's testing circuit

The gap between the African and Antarctic plates in Fig. 6B is another example of a gaping gore in Carey's sense. It can be called "Southwest Indian Ocean gaping gore". It is an artefact which disappears on a smaller Earth.

Similarly, pushing the 20 Ma Indo-Australian and African plates against the

Antarctic one produces an analogous gaping gore between them (Fig. 19A). It can be called the "Northwest Indian Ocean gaping gore"**.**



A **B**

Fig. 19. **A** *– northwest Indian Ocean gaping gore,* **B** *– southeast Indian Ocean gaping gore*

In the same way, pushing the -20 Ma Indo-Australian and Antarctic plates close to the African one produces a subsequent gaping gore between them (Fig. 19B). It can be called "Southeast Indian Ocean gaping gore".

All three gaping gores disappear on a smaller Earth. This is accomplished by Maxlow's (1995) reconstructions (Fig. 20)

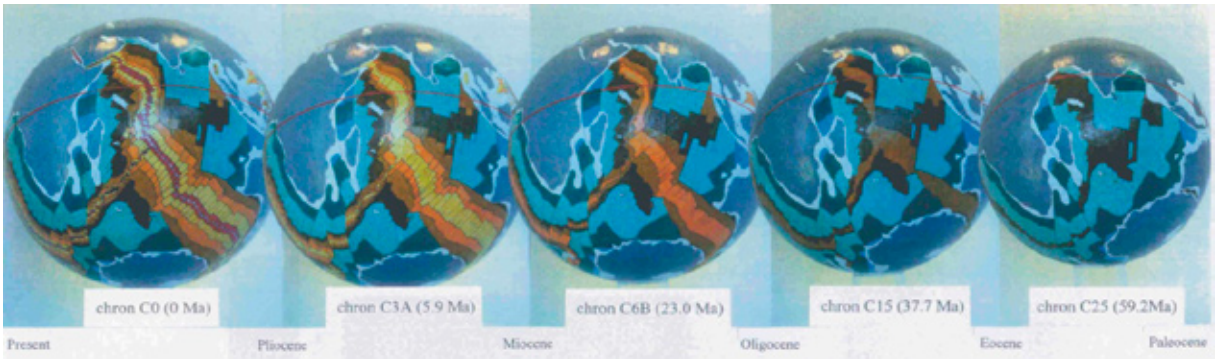


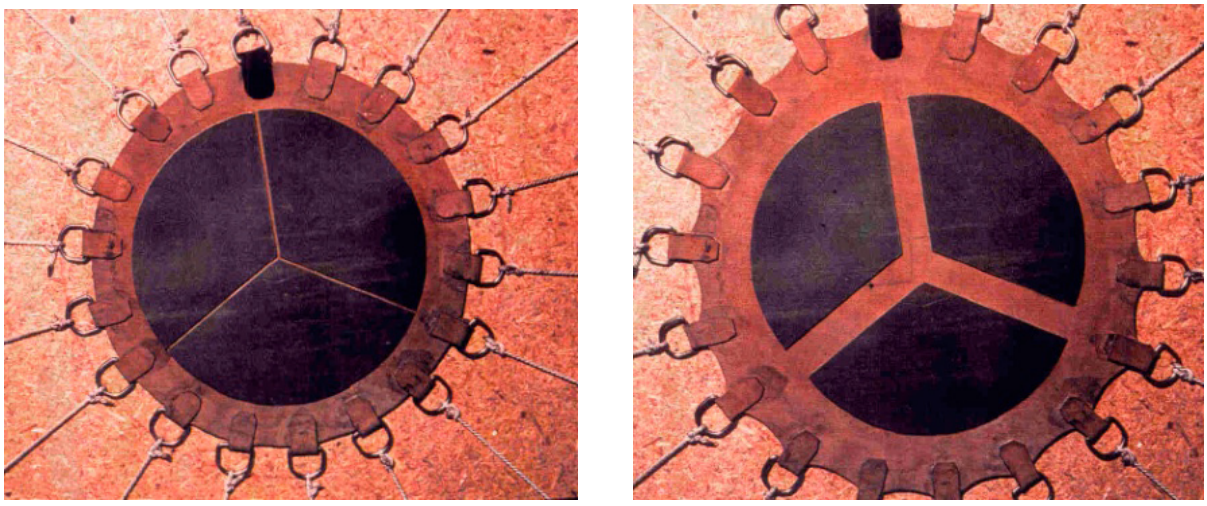
Fig. 20 *Maxlow's (1995) reconstruction of the Indian Ocean on the expanding Earth. The Ocean is closing without gaping gores*

7. Real geodynamics in the Indian ocean and other triple junctions

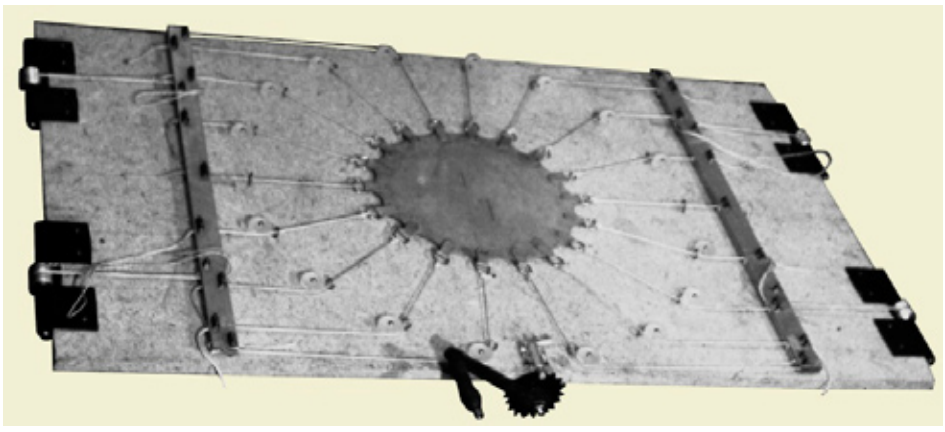
Oceanic ridges in the Indian Ocean form the greatest triple junction structure on our globe which denotes divergent movement of three plates that cover almost one hemisphere (Fig. 21A). Kinetic and dynamic explanation of such a structure is very simple on an expanding Earth. It can be demon-

strated on a physical model (Fig. 21B, C); see for details (Koziar, 1980) www.wrocgeolab.pl/floor.pdf and geometrical model (Koziar, 1994) see for details www.wrocgeolab.pl/plates.pdf

A



B



C

Fig. 21. **A** *– Indian Ocean triple junction with removed post-Paleogene lithosphere,* **B** *– evolution of the triple junction on the expanding Earth demonstrated on a physical model,* **C** *– full view of the device for physical modelling (own construction)*

8. Assumed pivotal diffuse plate boundaries: an attempt to save plate tectonics

a. Discovery of the non-closure of the Indian triple junction by plate tectonicists

The problem described in section 3 was noticed in the frame of plate tectonics several years after Morgan's test was carried out, when the paradigm was already at a full speed. It was done in two subsequent abstracts (Jordan *et al.,* 1976; Minster and Jordan, 1977) and a full paper by Minster and Jordan (1978). In these papers the global pattern of relative plate movement was calculated as the so-called RM2 (Relative Motion 2). The RM1 was calculated four years earlier by Minster *et al*. (1974) and the authors had then already noticed that *"the closure condition applied to different circuits did not yield consistent answers"* (p. 542). In the 1978 paper they wrote that the plate motion in the Indian Ocean [underlining, J.K.]:

> *(...) brings us to the major difficulty that we encountered in constructing RM2 (...) each of three legs of the Indian triple junction are populated by internally consistent data, but the three best fitting vectors sum to a vector (the closure vector) significantly different from zero.* (p. 5344).

The situation became paradoxical. First, plate tectonics had been "proved" on the basis of the Indian Ocean triple junction and now that very structure had become the main problem for the paradigm. Under these circumstances the fundamentals of this paradigm should have been revisited. However by this time plate tectonics had become so popular that another approach was chosen.

b. Assumed bending of the Indo-Australian plate

This other approach was the assumption that an internal deformation of at least one of the Indian Ocean plates is a cause of this difficult situation. To avoid, on a non-expanding Earth, all Indian Ocean gaping gores at least one of the plates should be bending over geological time so that its frontal (Indian Ocean) border has become more convex now than it was in the past. The authors (Minster and Jordan, 1978) examined all three plates in this respect. The Antarctic plate was ruled out at the start because of its very low seismicity. The African plate has a strong seismicity in the east African rift system. However the mechanics of this system are well-constrained and work in the

opposite direction than required. This means that Indian Ocean edge of the African plate has become progressively less convex. So this plate was ruled out too. The only remaining candidate was the Indo-Australian plate with its area of tectonic activity in its equatorial region.

To avoid the strange behaviour of the plates in the Indian Ocean (on a non-expanding Earth) the authors assumed the bending of the Indo-Australian plate to NE direction (Fig. 22A). Such bending allows to change the convergent movement of the kind shown in Fig. 8 to a divergent one.

It must be forcefully stressed that the above *ad hoc* hypothesis is not something added on to the remote periphery of the plate tectonics paradigm but concerns the analysis of a region critical to the original acceptance of that paradigm. So, plate tectonicists themselves discovered that Morgan's test failed, but they did not point it out.

The task of justifying such assumed bending was undertaken in numerous works starting from the one by Stein and Okal (1978). The single Indo-Australian plate was divided into two independent plates: Indian and Australian, separated by broad diffuse *"nonsubducting convergent plate boundary"* (the term introduced by Gordon *et al*., 1990). It is marked in Fig. 22B.

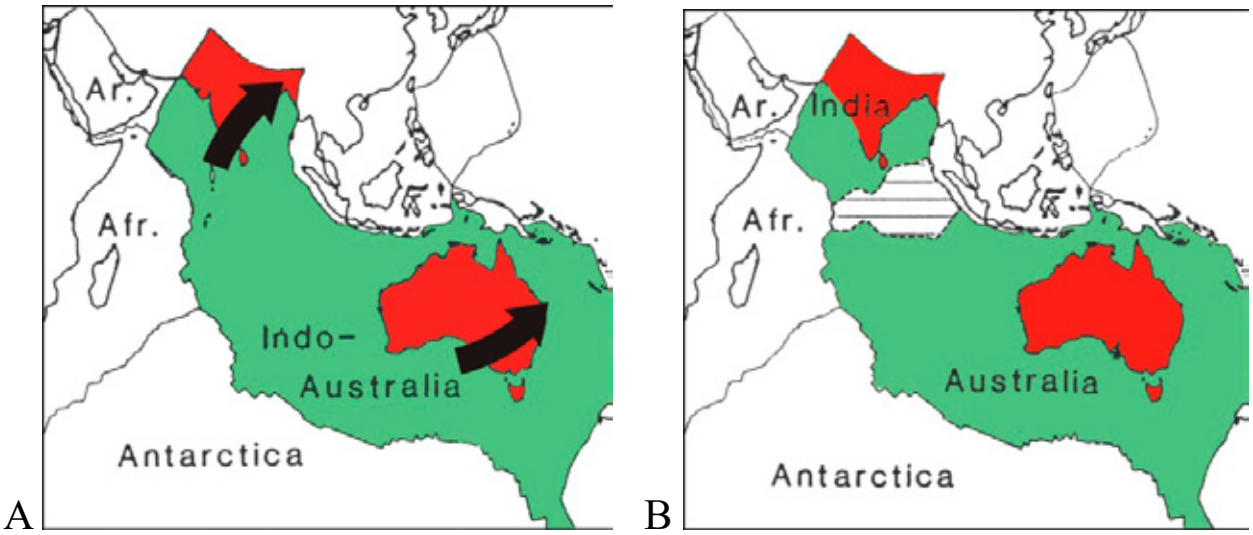


Fig. 22. *Ad hoc attempt to avoid convergence between African and Antarctic plates by:* **A** *– assuming bending out of the Indo-Australian plate to its concave side,* **B** *– breaking this single plate into Indian and Australian ones, separated by a diffuse boundary which is to facilitate such bending out (figures after Gordon et al. 1990, colours and arrows – J.K.)*

Establishing of such a new category of boundary was problematic for plate tectonics, which earlier acknowledged only linear boundaries in oceanic lithosphere. The range of the problem was well expressed by the title of Gordon's (1991) paper: "*Indian Ocean Violates Conventional Plate Tec-*

tonic Theory". In fact the Indian Ocean violates plate tectonics in general and at a much deeper level.

c. Strange position of the introduced Indo-Australian Euler pole and its pivotal mechanics

Invention of the strange bending of the Indo-Australian plate only transferred of an unacceptable situation from the arms of the Indian Ocean triple junction to the interior of one of three plates, where the situation is unclear and thus susceptible to different interpretations. This 'solution' is analogous to the clearly unacceptable bending toward the interior of the combined Antarctic-African plate shown in Fig. 8B. In further analogy to the situation presented in Fig. 8B, an Euler pole between the newly established plates should lie within the diffuse boundary between them. And so it has been proposed (Wiens *et al.*, 1985; Gordon *et al.*, 1990) – Fig. 23A.

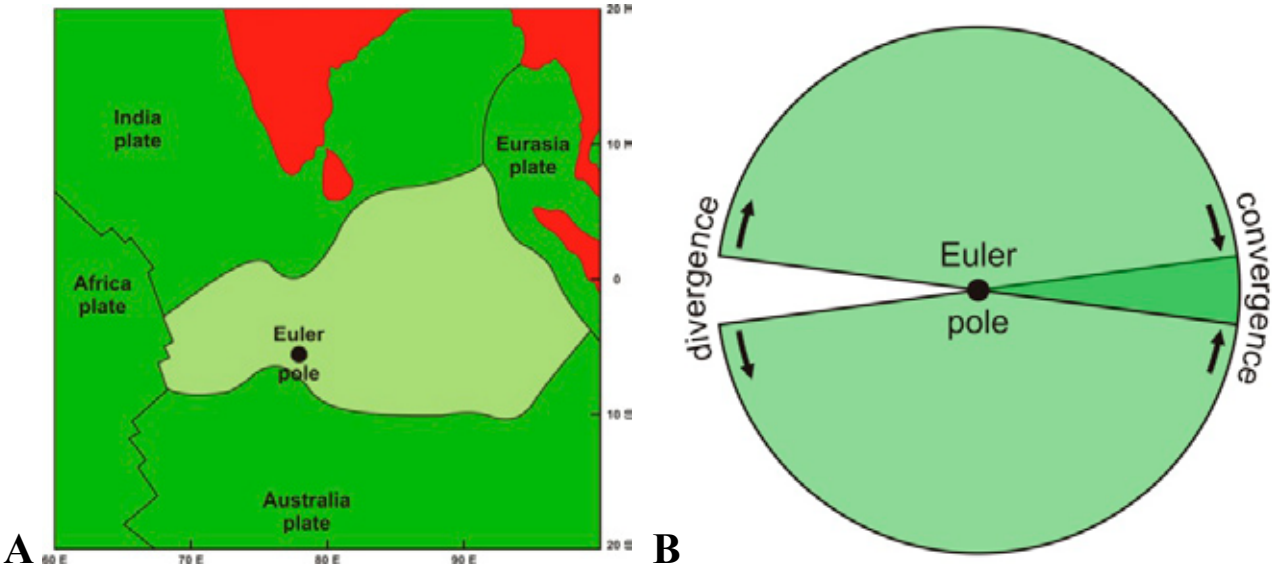


Fig. 23. **A** – *alleged position of Euler pole in Indo-Australian diffuse plate boundary (after Gordon et al. 1990),* **B** – *illustration of the alleged pivotal character of diffuse boundaries on a non-expanding Earth*

Such a position of the Euler pole means that the boundary is scissors-like or pivotal (by analogy to pivotal faults) – Fig. 23B. In Fig. 23A the short western part of the diffuse boundary is divergent but the much larger eastern part should be convergent. This is analogous to the fictitious mechanism presented in Fig. 8B.

Oceanic diffuse plate boundaries have proliferated with time and such a mechanism is now considered typical. Gordon (2009) wrote:

(...) poles of rotation across diffuse oceanic boundaries tend to lie with-

in the diffuse boundary itself, thus separating a region of contractional deformation from one of extensional deformation. (p. 287).

Also the above diffuse boundary within the Indo-Australian plate was widened and supplemented and thus the former single plate was broken into three pieces. The third piece is called the Capricorn plate (Royer, Gordon, 1997) – see Fig. 27A.

d. Apparent shortening of the east part of the Indo-Australian diffuse boundary

Tectonic activity within the Indo-Australian diffuse boundary is displayed by seismicity of generally N-S directed compressional stress (Petroy and Wiens, 1989) and by compressional faults in basaltic basement which generated compressional faults and folds in sedimentary cover in the southernmost part of the Ganges fan. The general shortening is calculated from these faults, which for Ceylon's meridian should be 22-37 km (Chamot-Rocke *et al.,* 1993) or only 11.2 km (Van Orman, *et al.,* 1995). The compressional faulting was an extremely short episode. It started in Late Miocene about 7 Ma ago and finished at about 5 Ma ago. Its end is marked by a prominent unconformity in uppermost Miocene (Weissel, *et al.,* 1980). It seems that recent seismic activity is only reactivation of this old event and has yet to cause any new recorded deformation in the sedimentary cover.

The compressional faults are generally considered to be previously normal faults connected with an old spreading centre (the local crust is of Cretaceous age), reversed at 7 Ma. However, an exclusively Cretaceous age of the tensional stage of the reversed folds is dubious. The short and intensive event of reversing is exactly the same as in continental basin inversions. Continental basins were earlier recognized as diffuse boundaries and they are generally tensional with short events of inversion connected with reversion of normal faults. The normal faulting lasted up to inversion and had not caused significant deformation in sedimentary cover. So, in case of the central Indian Ocean diffuse boundary, the normal faulting should also be in part of Miocene age. But that is not all.

In the frame of plate tectonics, basin inversion is connected with regional shortening and convergent plate movement. This leads to very big problems in explaining a sudden reversal of relative plate movement involving an assumed long-distance transfer of pressure through weak parts of the crust which until then have been stretching.

The simplest and most natural solution is to explain the inversion by a stronger tensional event of (the same motion as before), causing isostatic uplift and changing the normal faults to reverse ones. The contact of both walls of the reversed faults during the uplift is maintained by gravitational spreading of uplifted parts. Such a solution was applied to inversion of the Polish Basin in Late Cretaceous (Koziar, 2007; www.wrocgeolab.pl/inversion.pdf). So, reverse faulting is in fact connected with stretching not shortening of the lithosphere and its direct cause is uplifting.

The Central Indian diffuse boundary has a high heat flow. The flow should be linked with tensional decompression and subsequent thermal activation of upper mantle.

According to Stein and Okal (1978) "*If the NE-SW trending furrows and ridges to the west of the ridge* [Ninetyeast – J.K.] *are tectonic in origin they suggest NW-SE compression*" (p. 2240). However, according to the accepted interpretation of the west American Basin & Range province, they suggest NW-SE tension.

According to Petroy and Wiens (1989) recent seismicity confirms also contraction of the eastern part of the Indo-Australian diffuse boundary marked by compressional stresses deduced from earthquakes. Lines of these stresses are parallel to the Sumatra-Nicobar trench. However we can consider the tension directions resulting from focal mechanism solutions as a real cause of the earthquakes. Then the earthquakes denote tensional stresses perpendicular to Sumatra-Nicobar trench (Fig. 24) which is (as all trenches) a tensional structure.

Plate tectonicists, dealing with the Indo-Australian diffuse boundary, try to attribute recent left-lateral motion to the Ninetyeast ridge (Stein and Okal, 1978; Wiens *et al.* 1985; Wiens et al. 1986; Gordon et al.1990). However the general motion along the Ninetyeast transform fault was dextral (Fig. 25) before it ceased 32 Ma ago.

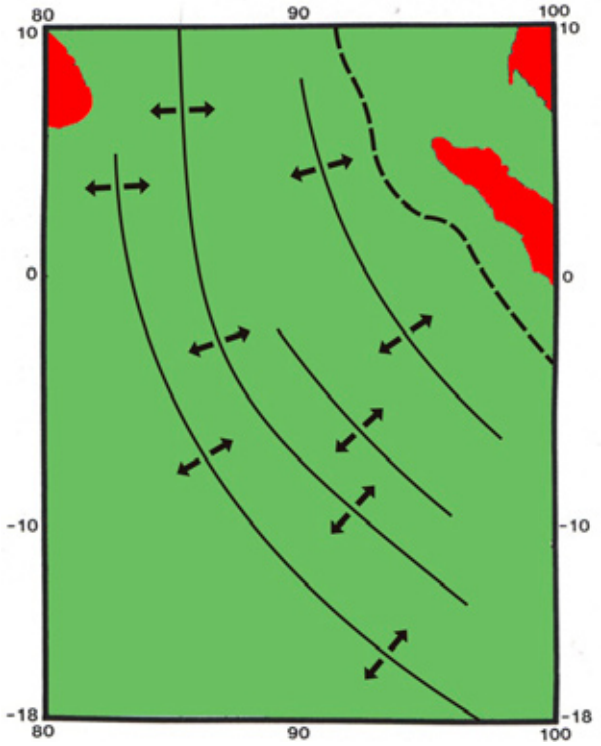


Fig. 24. *Lines of tension perpendicular to Sumatra-Nicobar trench – broken line (explanation in text)*

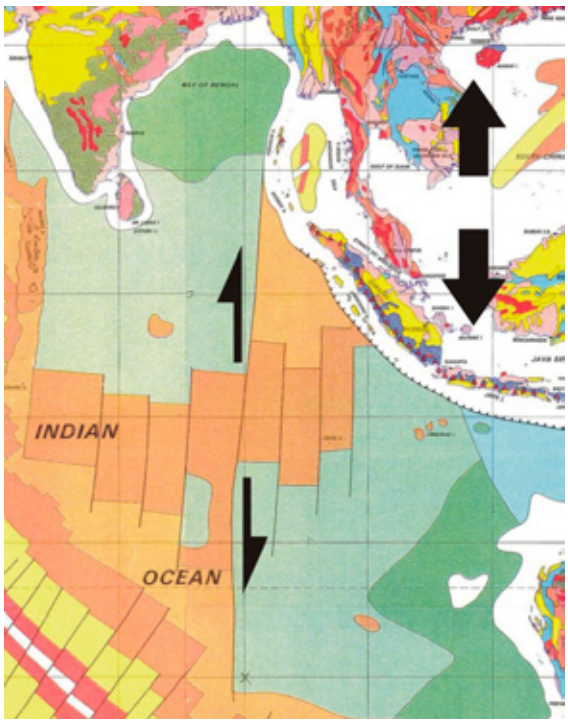


Fig. 25. *Dextral motion on Ninetyeast transform fault and divergence between Australia and southeast Asia (explanation in text)*

This dextral motion does not however signify a collision of India with the Asian continent but moving away of Australia from India and the Asian continent. The latter motion (another critical process for plate tectonics) is indicated by thick arrows in Fig. 25. The justification of the divergence between south-east Asia and Australia is given in my paper (Koziar, 1991); www.wrocgeolab.pl/Pacific.pdf .

Nonexistence of collision between India and the rest of Asia collides of course with a main tenet of the plate tectonics paradigm. However the fold belts develop in fact by the tension-diapiric-gravitational mechanism. This was first shown by Carey (1958, 1976) and is presented in the papers by Koziar and Jamrozik (1985); www.wrocgeolab.pl/Carpathians.pdf and Koziar (2005).

Thus the tension between Australia and southeast Asia is realised by bending-out of the Indo-Australian plate after dextral movement on the Ninetyeast transform fault ceased. The ceasing was caused by the tearing away Antarctica from Australia and thus a significant decrease of tension between Australia and southeast Asia. The bending-out is modelled below.

9. Real bending-out deformation of the Indo-Australian plate

Bending-out of the Indo-Australian plate can be modelled on similar device as the one (Fig. 21C) used for modelling of development of the Indian Ocean triple junction. This is a more recent version of the former device. The Indo-Australian plate is simulated by half of a compact disc (CD) covered by red self-adhesive paper. The model plate is cut in half and put on a map of the east hemisphere (Fig. 26A) for comparison with a real situation. Then both halves of the model plate (the future separate Indian plate and Australia plate) are connected by two pieces of rubber band glued at their ends to the paper. Then the whole model is put on a silicon disc being stretched and simulating the expanding sublithospheric mantle (Fig. 26B).

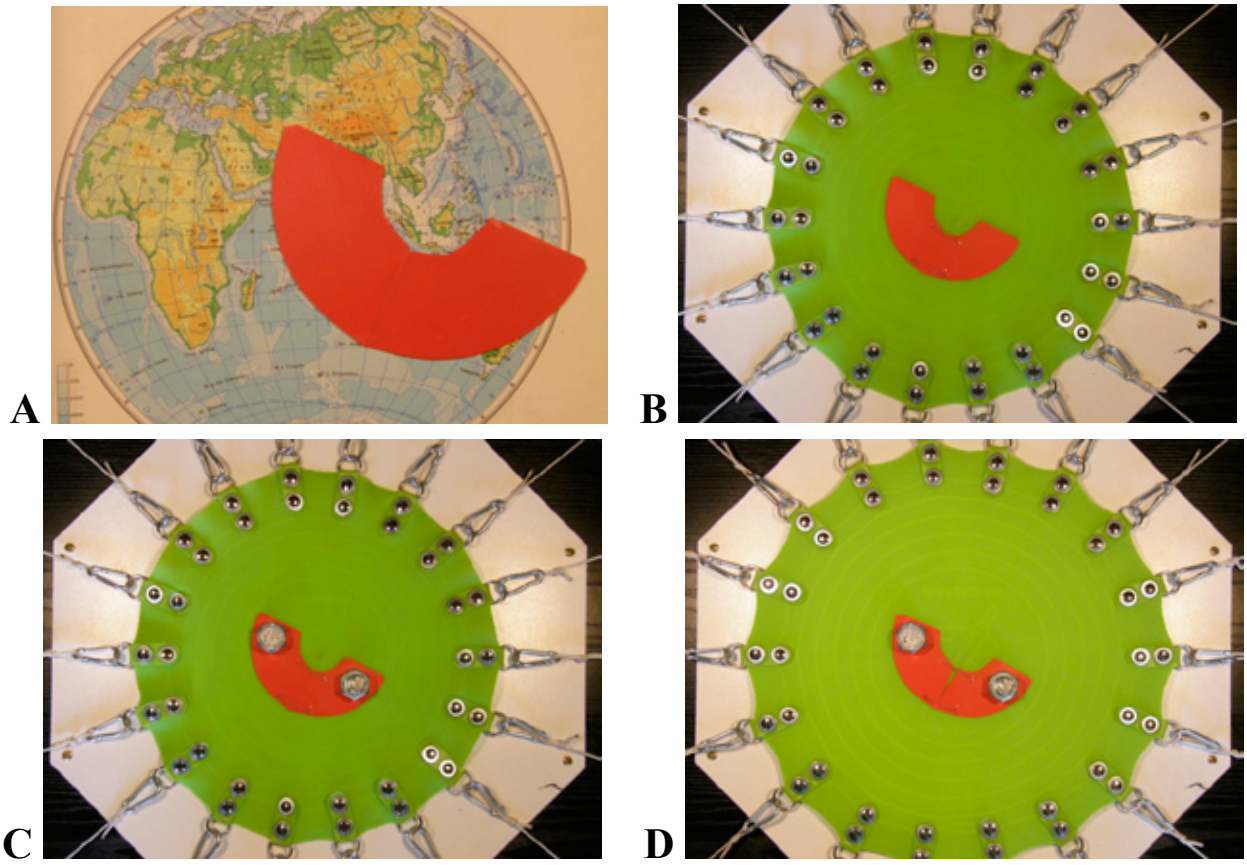


Fig. 26. *Modeling of bending-out of the Indo-Australian plate on the expanding basement (explanation in text)*

Because the CD plate is very light the ends of the model plate were burdened with metal weights (Fig. 26C) to assure friction able to overcome the elasticity of the rubber fibres. Weighting the model at its ends is justified because there is continental lithosphere more connected with sublithospheric mantle than is the oceanic lithosphere. During stretching the silicon disc the model of Indo-Australian plate is bending-out (Fig. 26D) as was expected.

As was mentioned in subsection “Strange position of the introduced Indo-Australian Euler pole and its pivotal mechanics” the diffuse boundary between India and Australia was enlarged by other authors and a third plate (the Capricorn plate) was postulated (Fig. 27A – according Vita-Finzi, 2004). Such a diffuse boundary fits better with bending-out of the Indo-Australian plate (Fig. 27B).

Of course bending-out of the Indo-Australian plate reduces the size of the Indian Ocean triple junction gaping gores (Figs 7B and 19A and B). Deformation within the African plate (separation of the Somalia plate) has a similar effect – see comment in subsection 7B.

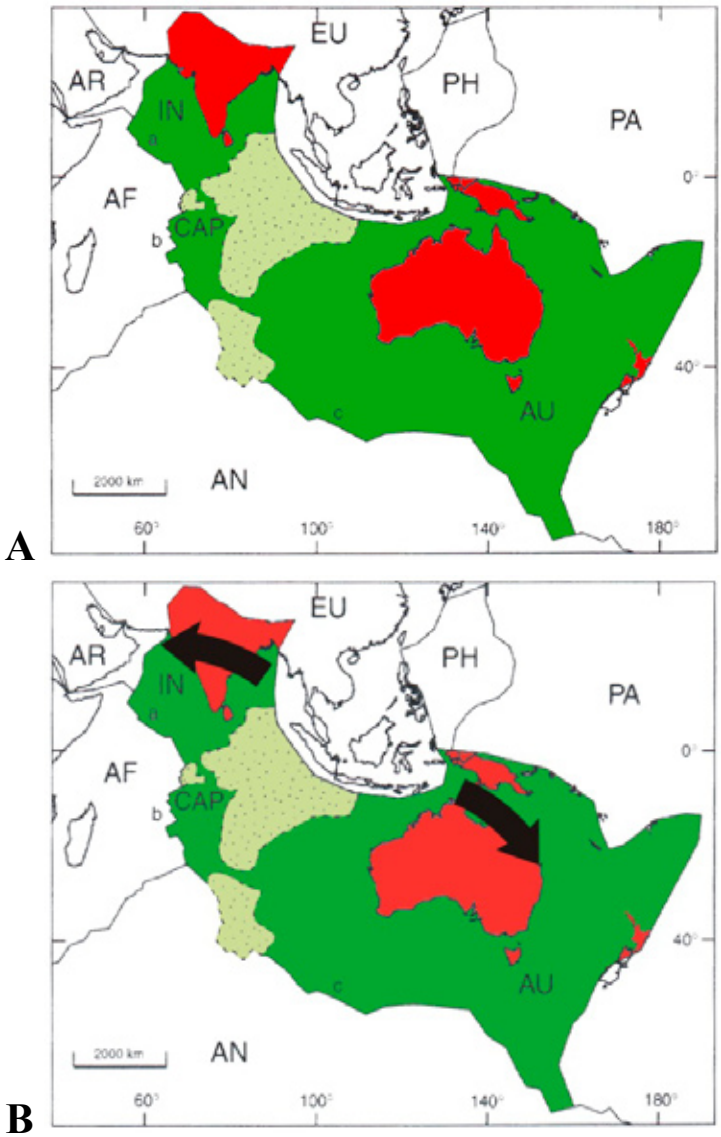


Fig. 27. *Bending-out of Indo-Australian plate (explanation in text)*

Thus, if the plates bordering the Indian Ocean triple junction had been more rigid (as according the early assumption of plate tectonics), their gaping gores would have demonstrated the process of expansion of the Earth even more spectacularly.

Summing up – the geotectonics of the Indian Ocean is quite simply beyond the plate tectonics paradigm.

Chu and Gordon (1999), struggling with extraordinary complicated tectonics of the Indian Ocean on a non-expanding Earth, concluded that: *Simplicity has not been a good guide in predicting the tectonics of the Indian Ocean,* p. 66. The truth is quite opposite but on the expanding Earth.

10. Plate tectonics problems with triple junctions

Triple junctions have been on a losing streak in the frame of plate tectonics from the very beginning. No set of convection currents or slab-pull-ridge-push mechanisms could be harmonized with these structures and plate tectonics gave up very early and generally on its driving mechanism (its only "advantage" over an expanding Earth) and focused instead on its alleged success in describing the kinematics of plate movements.

However, as this paper has revealed, plate tectonics has not been successful as a kinematic theory, either – as its difficulties with triple junctions show.

McKenzie (1970) wrote:

> *Though McKenzie and Parker (1967) made and attempt to discuss points where three plates meet, they were not especially successful.* (p. 327).

In the paper (McKenzie and Morgan, 1969) devoted exclusively to the triple junctions the problem became even more intricate. The more it become in the quoted paper (McKenzie,1970) where the author wrote that the "*results will not be discussed here in detail, since the problem is somewhat complicated*"(p. 328). The problem was still complicated and still unsolved in the following paper (McKenzie and Parker, 1974). The authors wrote in their abstract:

> *an attempt is made to determine the value of the relative acceleration of the plates forming a single triple junction when they are governed by kinematic effects alone, but the resulting values do not agree with the available observations.* (p. 285).

The non-closure of Eulerian circuits for triple junctions has now become typical for these structures. Apart from the one in the Indian Ocean, two other prominent triple junctions: Pacific-Cocos-Nazca and Sur-Nubia-Antarctic also fail to close (DeMets *et al.,* – 2010).

11. Global consequences of the acceptance of the false Eulerian plate motions

After Morgan established the vectorial principles of plate tectonics, subsequent global circuits were constructed for global calculations of plate motion. It is interesting that only the author of the first global calculation of plate motion (Chase, 1972) mentioned the assumption of "*constant area of the Earth*" (p. 117) which is crucial for the whole procedure.

Below, the global circuit constructed by DeMets *et al*. (1990) is presented (Fig. 28).

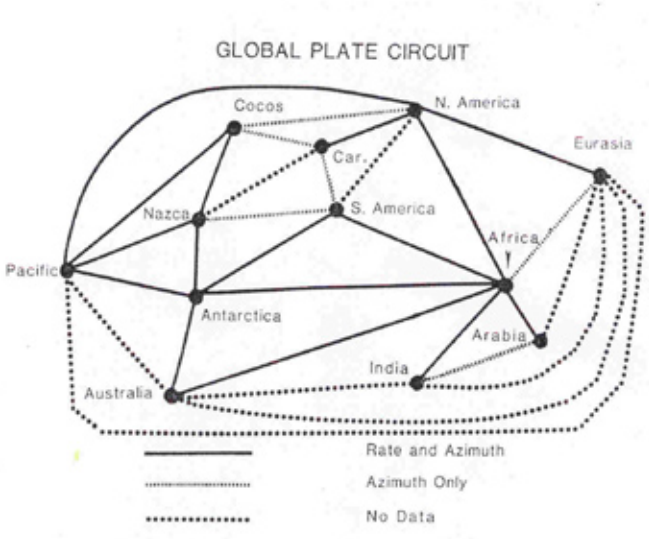


Fig. 28. *Global net of Euler vectors circuits (by DeMets et al., 1990)*

It must be pointed out again that all direct quantitative determinations of relative movement between plates were made only on the basis of spreading at oceanic ridges. These relations are represented in Fig. 29 by solid lines. All these divergent motions agree with an expanding Earth. Relative movements on assumed convergent plate boundaries were calculated indirectly (by summing Euler vectors), starting from divergent boundaries and assuming a "constant area of the Earth" (dotted lines). It is obvious that the real empirical divergence combined with the above assumption must lead to only deduced convergence.

Such a logical structure is clearly visible in Le Pichon's 1968) text:

> *If the earth is not expanding, there should be other boundaries of crustal blocks along which surface crust is shortened or destroyed.* (p. 3673).

In Eulerian calculations this approach gives quantitative results. These quantitative estimates of convergence, though obtained in a sophisticated, mathematical way, are not any proof of convergence. Such a "proof" is only

one of plate tectonics' circular arguments[1], but here they are performed by means of mathematics. In particular, the total area of the oceanic lithosphere, produced by spreading (which is about 3.5 km^2/yr), must be in this way completely "consumed". So, referring to the *well maintained balance of the Earth surface area* as an argument against expanding Earth (Dziewoński, 1999, p. 28) is a complete misunderstanding.

Acceptance of Eulerian plates kinematics has had a special influence on space geodesy. Its mobile reference frames are based on this concept. This topic is discussed below and in separate papers (Koziar, 2011, 2018 – www.wrocgeolab.pl/geodesy1.pdf ; www.wrocgeolab.pl/geodesy2.pdf).

Forcing of geotectonics into an artificial **ω**-space and cloaking it by sophisticated calculations is mainly responsible for the unjustified prestige success of plate tectonics and the marginalization of the geological and empirical way of thinking in geotectonics.

However, plate tectonics vectorial calculations, starting from real spreading areas, lead also to results contradictory to plate tectonics. Such is the global plan of plate motions which supports Carey's Arctic Paradox and consequently proves the expansion of the Earth (Koziar, 2011, www.wrocgeolab.pl/geodesy1.pdf).

12. Problems of the Eulerian motion of plates with driving mechanism and absolute reference frames

Both driving mechanism and absolute reference frame of lithospheric plates are very simple on an expanding Earth. The driving forces are only the friction forces between rigid plates and the underlying stretched plastic mantle. The expanding mantle is simultaneously the absolute reference frame for the rigid plates (Koziar, 1980 and 1994; www.wrocgeolab.pl/floor.pdf and www.wrocgeolab.pl/plates.pdf), see also Figs 21, 26, 39 and 40 of this paper. The same topics are hopeless problems for Eulerian motion of plates i.e. the motion on a non-expanding Earth. I pass over the hopeless and ineffective attempts of plate tectonics with convection currents and slab-pull-ridge-push mechanisms and keep to the problem of its absolute reference frames. There are two frames in common use: the hot spot absolute reference frame and the NNR (no-net-rotation) absolute reference frame. The plans of global plate motion in both frames will be presented below. Apart

[1] Plate tectonics circular arguments consists in building models based on a non-expanding-Earth assumption and then treating them as proofs of this assumption.

from differences in absolute reference frames there are differences in the data utilised. Some are geological (spreading rates and azimuths of transform faults) and some geodesic (space geodesy measurements). The first are averaged over the past 3 Ma the second over the last few decades. Eulerian results using of both kinds of measurement will be discussed separately.

a. Hot spot absolute reference frame – geological data

Hot spots over mantle plumes really exist but they are impossible on a non-expanding Earth because of the assumed great mobility of the upper mantle connected with assumed plate tectonics driving mechanisms. All mantle plumes are moving apart from one another. This was first noticed by Stewart (1976) and was properly treated by him as one of the proofs of Earth expansion (see Koziar, 2004; www.wrocgeolab.pl/handbook.pdf) This moving apart of mantle plumes on the expanding Earth is connected with their stable position relative to the mantle. On the non-expanding Earth the mantle plumes, moving relatively to each other are also moving relative to the mantle. Thus they are a poor base for an absolute reference frame for Eulerian motion of the plates. Despite this problem they were used by plate tectonicists to play this role. The first attempt was made by Minster *et al.* (1974). See Fig. 29.

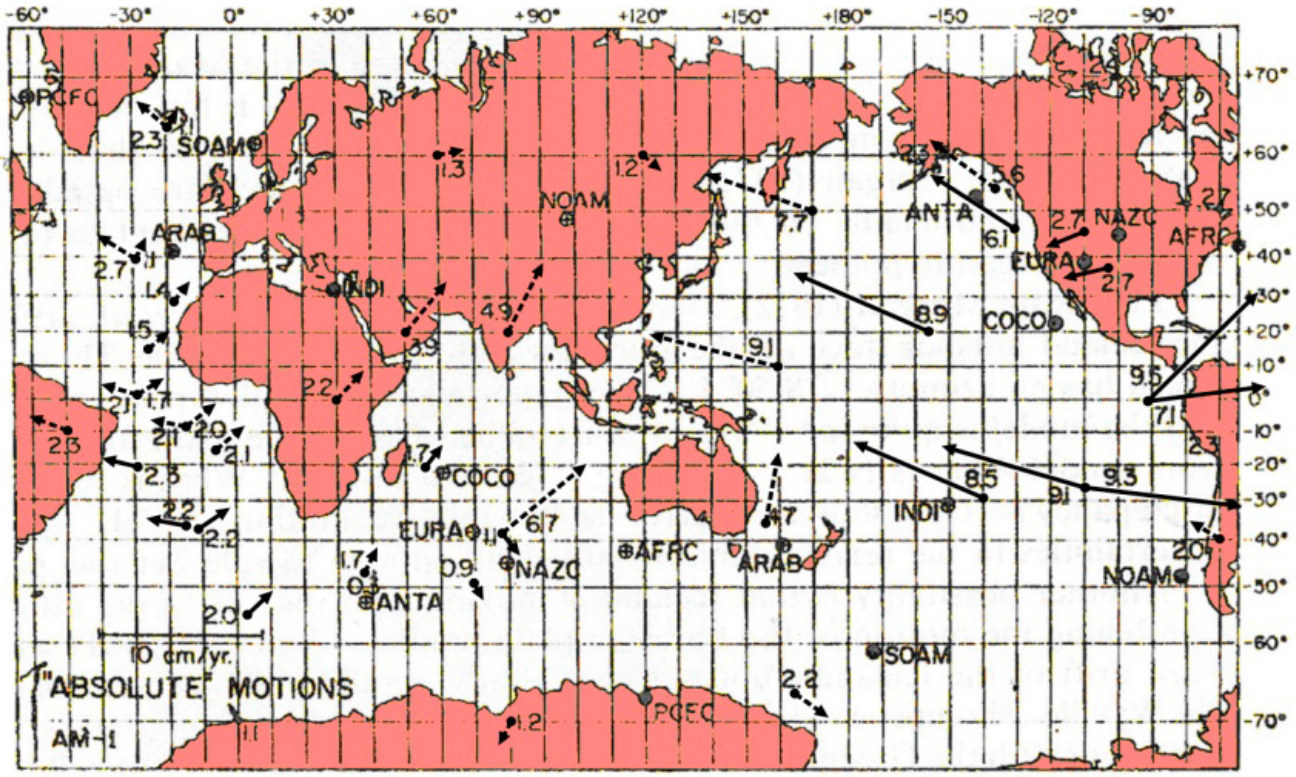


Fig. 29. *Present global plate motion in hot spot absolute reference frame (Minster et al. 1974)*

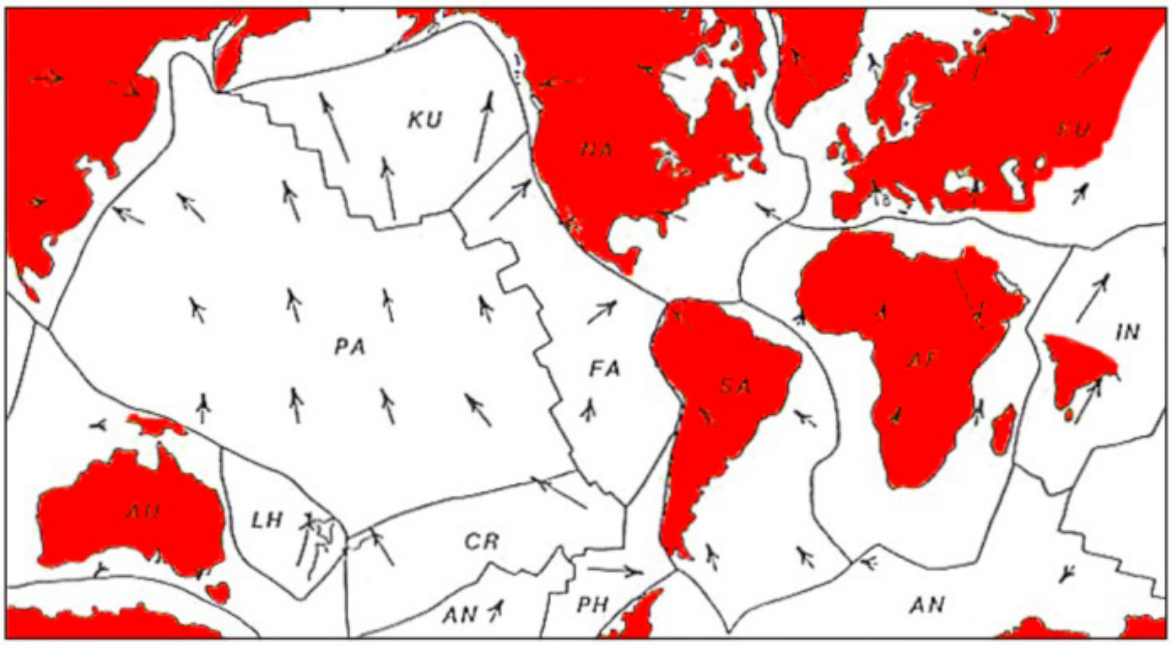


Fig. 30. *Global plate motion in hot spots absolute reference frame in Paleocene (Jurdy and Gordon, 1984)*

A peculiar feature of both obtained global plans is general northward motion of the plates away from the Antarctic plate. The pattern is repeated in other attempts of this kind. These strange plans will be commented on later.

b. NNR absolute reference frame – geological data

NNR means no-net-rotation condition for the sought-after absolute reference frame. It means that in this reference frame the sum of all Euler vectors (of all plates) should be equal to zero. The method is based on so-called Tisserand condition for finding the simplest reference frames for various physical systems. The first attempts to apply the Tisserand condition to Eulerian plate motion were made by Lliboutry (1974) and Solomon and Sleep (1974). However the first transfer of global motions, calculated originally relative to the Pacific plate, to the NNR reference frame, was made by Minster and Jordan (1978). However the authors did not present a map of such absolute motions. This was done first by Argus and Gordon (1991) in their NNR-NUVEL-1 model (NUVEL is abbreviation from Northwestern University VELocities). The model was deduced from a basic model of movement relative to the Pacific plate – NUVEL-1 (DeMets *at al.* 1990). In 1994 the NNR-NUVEL-1 was updated using a revised geomagnetic timescale (DeMets *et al.* 1994) and labelled NNR-NUVEL-1a. A coloured map of this plan (Fig. 31) is available in Internet.

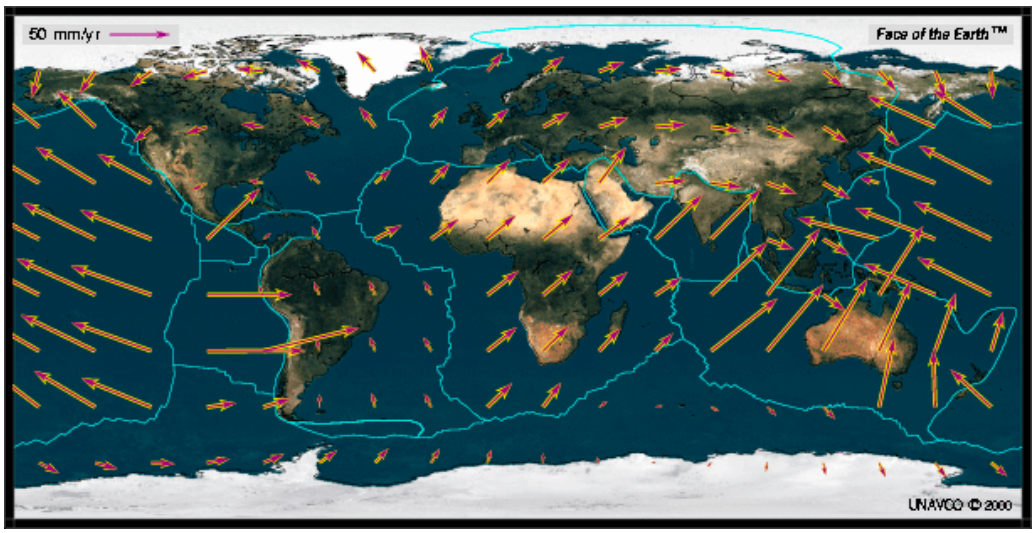


Fig. 31. *Present global plate motion obtained by plate tectonics in the NNR absolute reference frame (DeMets et al., 1994)*

As is visible the plan is almost the same as in Fig. 29.

c. NNR absolute reference frame – geodetic data

Space geodesy has developed its own absolute references frames also using NNR condition and Eulerian calculations. They are called International Terrestrial Reference Systems (ITRSs). Because they are evolving with time they are periodically updated and identified by the year of updating – for instance ITRF2005. The global plans of plate motions is also obtained by Eulerian calculations. The global plan for ITRF2005 was calculated by Altamini *et al*. (2007) and is presented below in Internet version (Fig. 32).

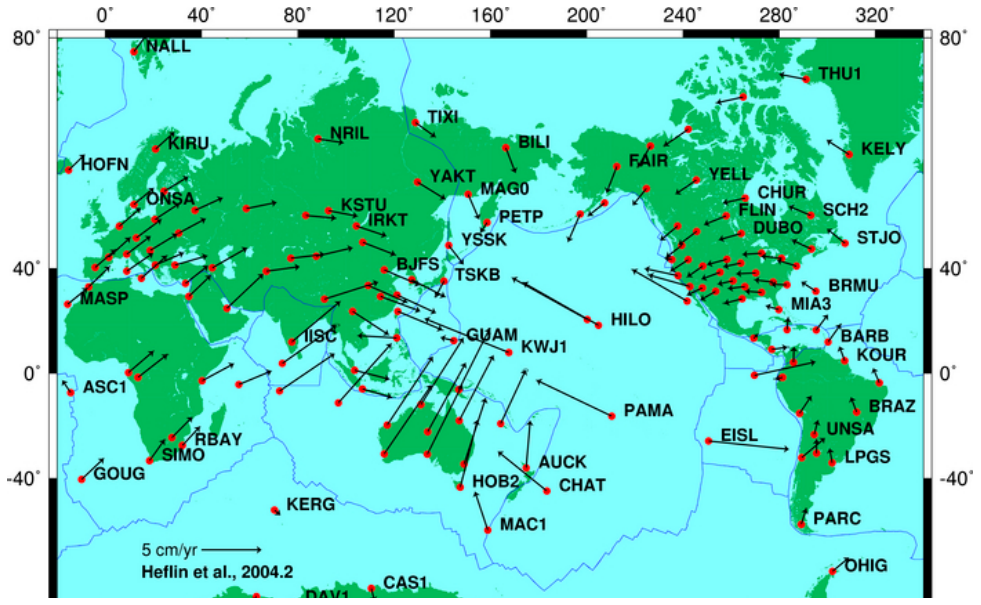


Fig. 32. *Global NNR plate motion based on geodetic data*
http://itrf.ensg.ign.fr/ITRF_solutions/2008/ITRF2008.php

As is visible the plan is almost the same as in Fig. 31.

d. MORVELs and GEODVELs

Global plans of plates motions are continuously updated and more and more plates are enumerated. Recently their number reached 56 (Argus *et al.,* 2011). The plans based on geological data are called MORVELs (Mid Ocean Ridges VELocities) and those based on space geodesic data GEODVELs (GEODesic VELocities). These are compared each other, *e.g.* (Argus *et al*., 2009; Altamini *et al*., 2012) but the differences are small and general global plan is always as in Figs. 31 and 32.

e. Impossibility of global Eulerian motion of plates

All plates (apart from the Antarctic plate) on all plans of Eulerian absolute global motions move northward and this is not balanced by proper southward motion. Reverse motion of plates is very weak and problematic. One main current, starting from Africa and Europe in north-east direction, turns indeed to south-east in east Asia but significantly and inexplicably ceases. The other main current, starting in north-west direction in the east part of north American plate, turns indeed to south-west in the west part of North America and should cause a collision with the Pacific plate. However there is not a convergent boundary but a transform fault boundary. What is more, in front of the San Andreas fault there is a very wide area of tension (Basin & Range province) not compression.

To sum up, the conclusion is that global Eulerian motion of lithospheric plates is impossible. The unreasonable plan of global plate motion that results when the motions are assumed to be of Eulerian character is resolved in the frame of Carey's Arctic Paradox that is – on the southwardly expanding Earth (see below). Of course on the expanding Earth relative and absolute motions of plates have nothing to do with Euler's theorem.

13. Carey's Arctic Paradox as a proof of the dominant southward expansion of the Earth

a. Carey's Arctic Paradox – schemes

Carey (1976) noticed that all plates apart from the Antarctic one move northward. The plan is well visible around the Antarctic plate (Fig. 33).

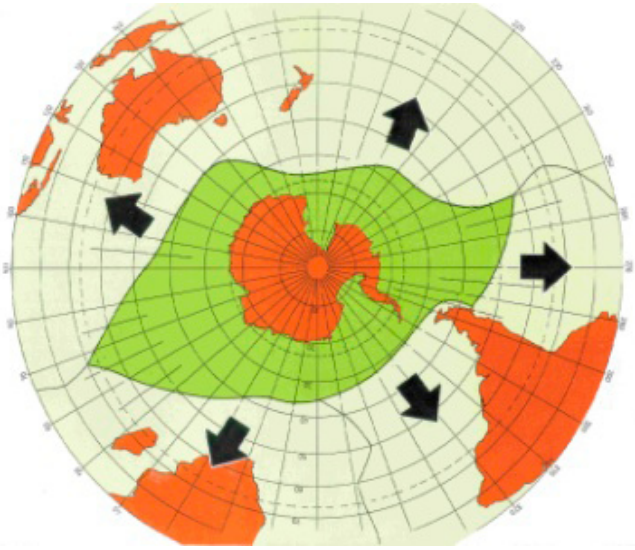


***Fig. 33**. Northward movement of all plates surrounding the Antarctic plate*

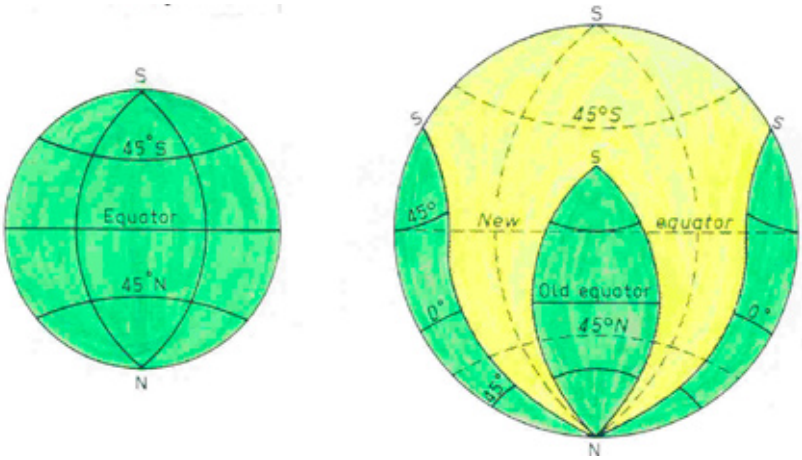


***Fig. 34**. Arctic Paradox presented in Carey's model of a flower bud (Carey, 1976)*

Carey confirmed this movement in the northern hemisphere with data on the northward shifting of paleoclimatic zones and paleomagnetic latitudes. On an Earth of constant dimensions such a northward movement of the plates should result in convergence in the Arctic zone. However the dominating structure in this region is the Arctic Ocean which has a divergent origin. This structure documents a general southward movement of plates in the Arctic area. The two opposite movements are precisely what constitute the Arctic Paradox (but only on a constant-size Earth). The only solution of this paradox is an expanding Earth.

Carey demonstrated the solution on his model of a flower bud opening upwards (Fig. 34) but it plays better in reverse position (Fig. 35A) with conventional orientation of geographical poles. Carey's model can be compared with a real flower bud (Fig. 35B) and with professor Józef Oberc's "shabby soccer ball" model (Fig. 35C). The latter takes into account the position of the Antarctic plate.

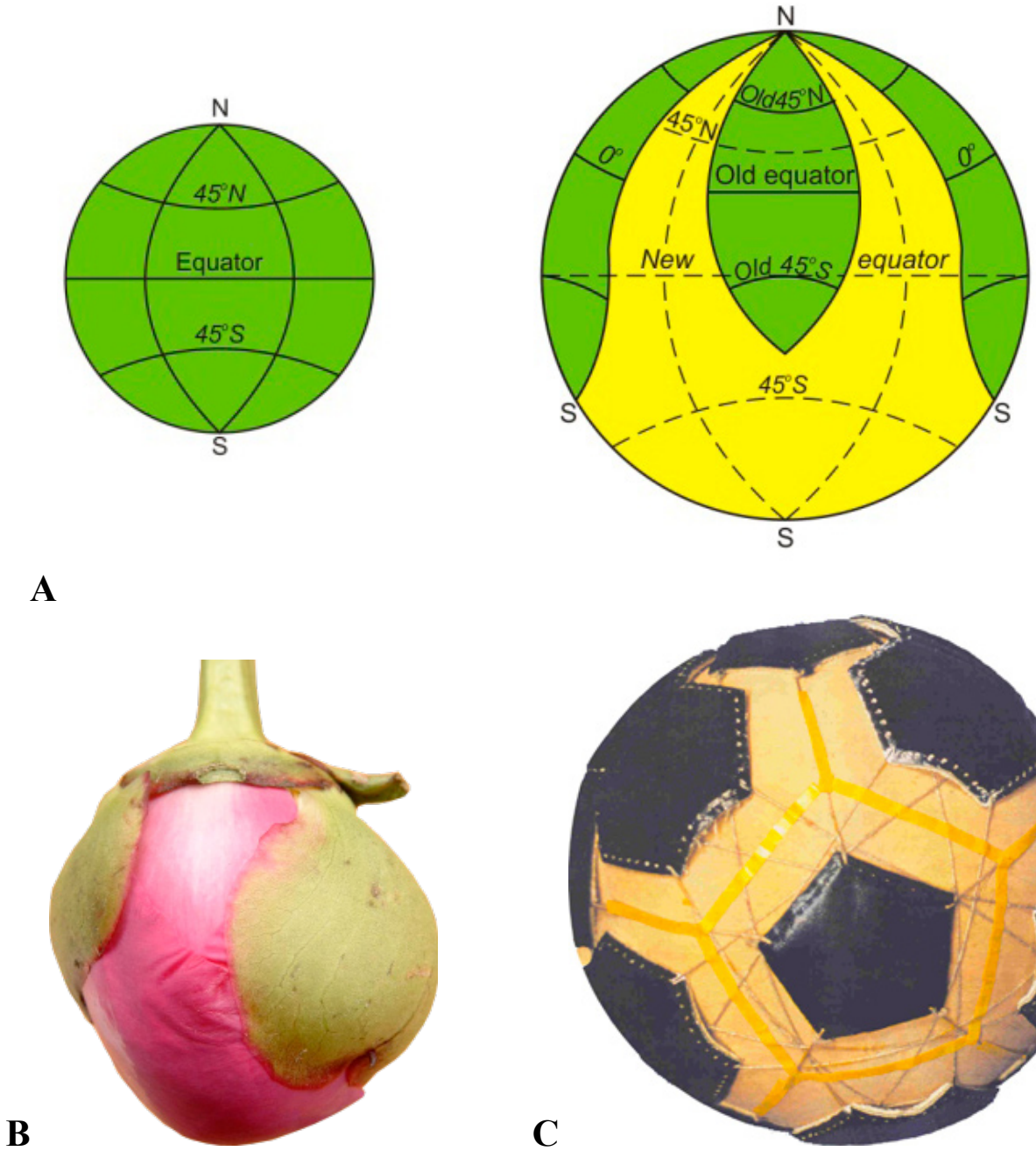


Fig. 35. *Various models of the Arctic Paradox:* **A** *– Carey's model of flower bud in inverted position,* **B** *– natural model of peony bud,* **C** *– Oberc's model of "shabby soccer ball"*

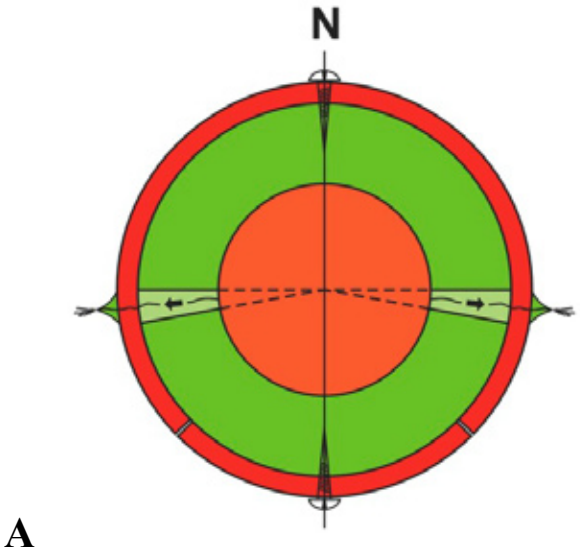
The solution of the Arctic Paradox is not only the expanding Earth but the asymmetrically southward expanding Earth. The essential movement is in fact the southward movement of the deep mantle relative to almost all plates except for the Antarctic one. The northward movement of plates relative to the mantle is only an apparent one.

All the plates in the Arctic Paradox pattern, apart from the Antarctic one, form one huge northern megaplate. This megaplate has global integrity despite large tears between its partially independent fragments.

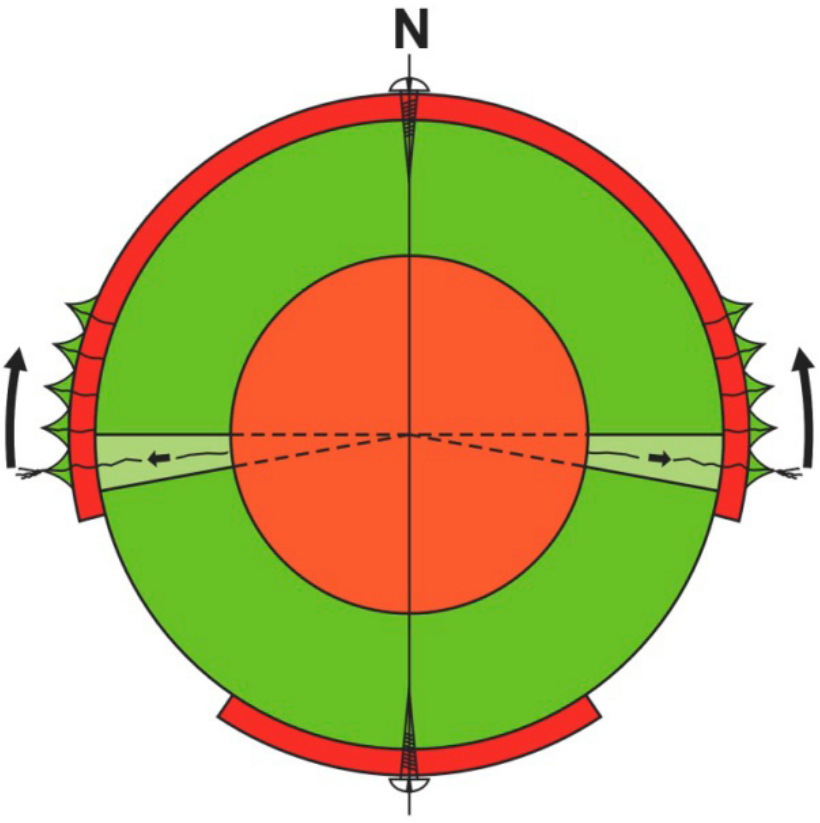
b. Hot spots and their volcanic chains confirm Carey's Arctic Paradox

Independent confirmation of the Arctic Paradox pattern (not used by Carey[2]) is provided by volcanic chains generated by hot spots.

Let us consider a small continental Earth with an initial northern megaplate, a small southern plate and two antipodal mantle plumes placed in its equatorial plane (Fig. 36A).



A



B

[2] Carey's attitude to the concept of hot spots was critical.

C

Fig. 36. *Own model of the Arctic paradox with hot spot volcanic chains,* **A** *– initial situation,* **B** *– present situation (explanation in text),* **C** *– global pattern of hot spot volcanic chains (Thompson and Morgan, 1988)*

During expansion the whole megaplate apparently migrates northward (apart from north pole) and both mantle plumes (preserving constant position in the mantle) produce volcanic chains directed northward (Fig. 36B). This rule is valid for all chains on the northern megaplate. In fact the megaplate is being enlarged all the time by oceanic lithosphere and reaches all the time to the southern plate which is being enlarged in the same way (see Fig. 33).

Because the megaplate had to be torn apart and lengthen latitudinally during expansion (see all models in Fig. 35), the volcanic chains will actually be oriented NW or NE, while always preserving their northern component. Such a situation is in fact observed (Fig. 36B).

c. Carey's Arctic Paradox based on a real geography of the plates

Carey's Arctic paradox pattern can be more precisely demonstrated using the real geography of continents and plates and removing all of the young post-Paleogene lithosphere together with the whole Antarctic plate. For better visualisation of the process of southward asymmetrical expansion, the whole structure can be compared with Carey's model of the opening flower

bud. For this effect a stem was added at the North Pole (Fig. 37A). The green areas (parts of the northern megaplate) can be compared to sepals, and yellow (mantle basement) - to petals of a flower bud.

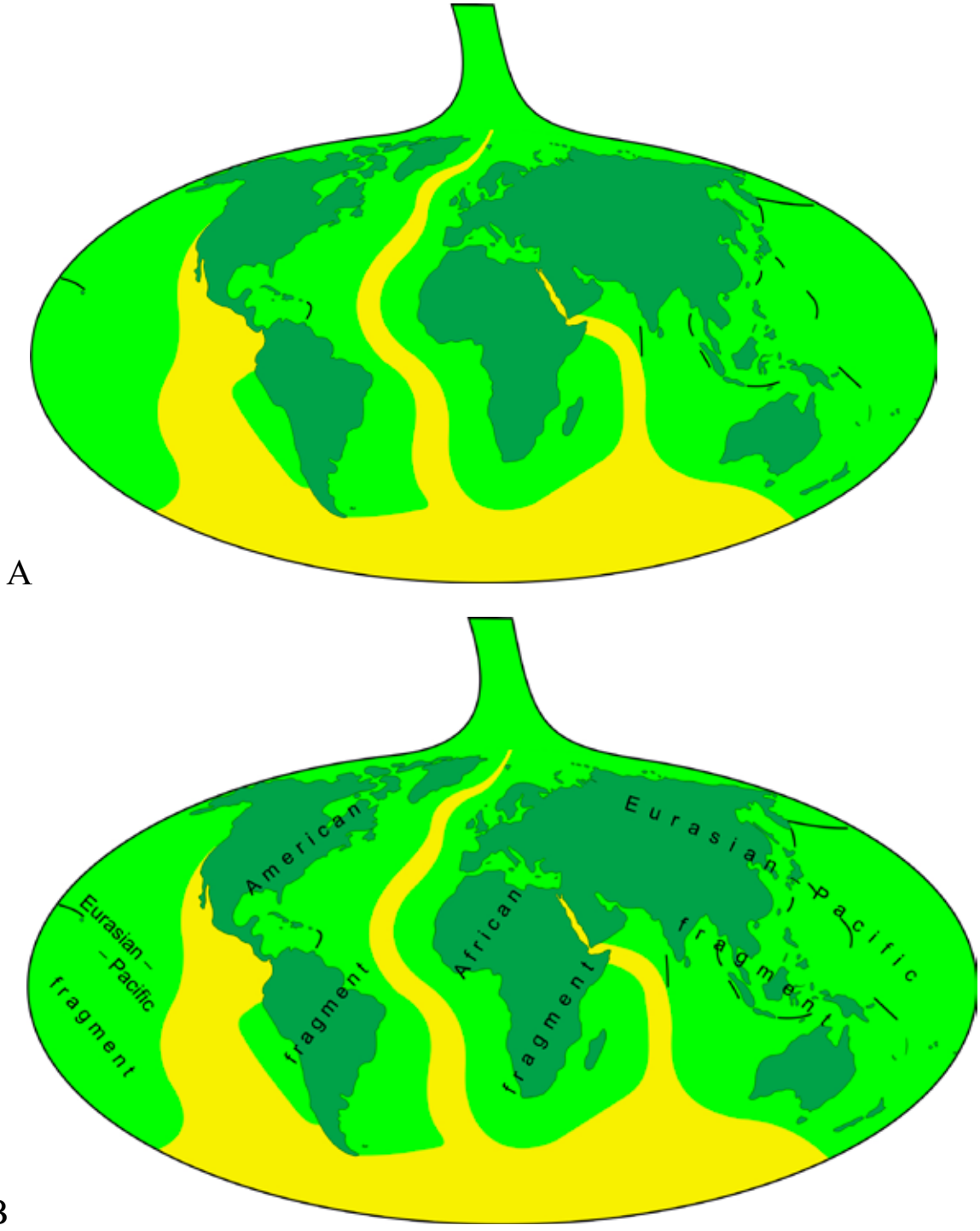


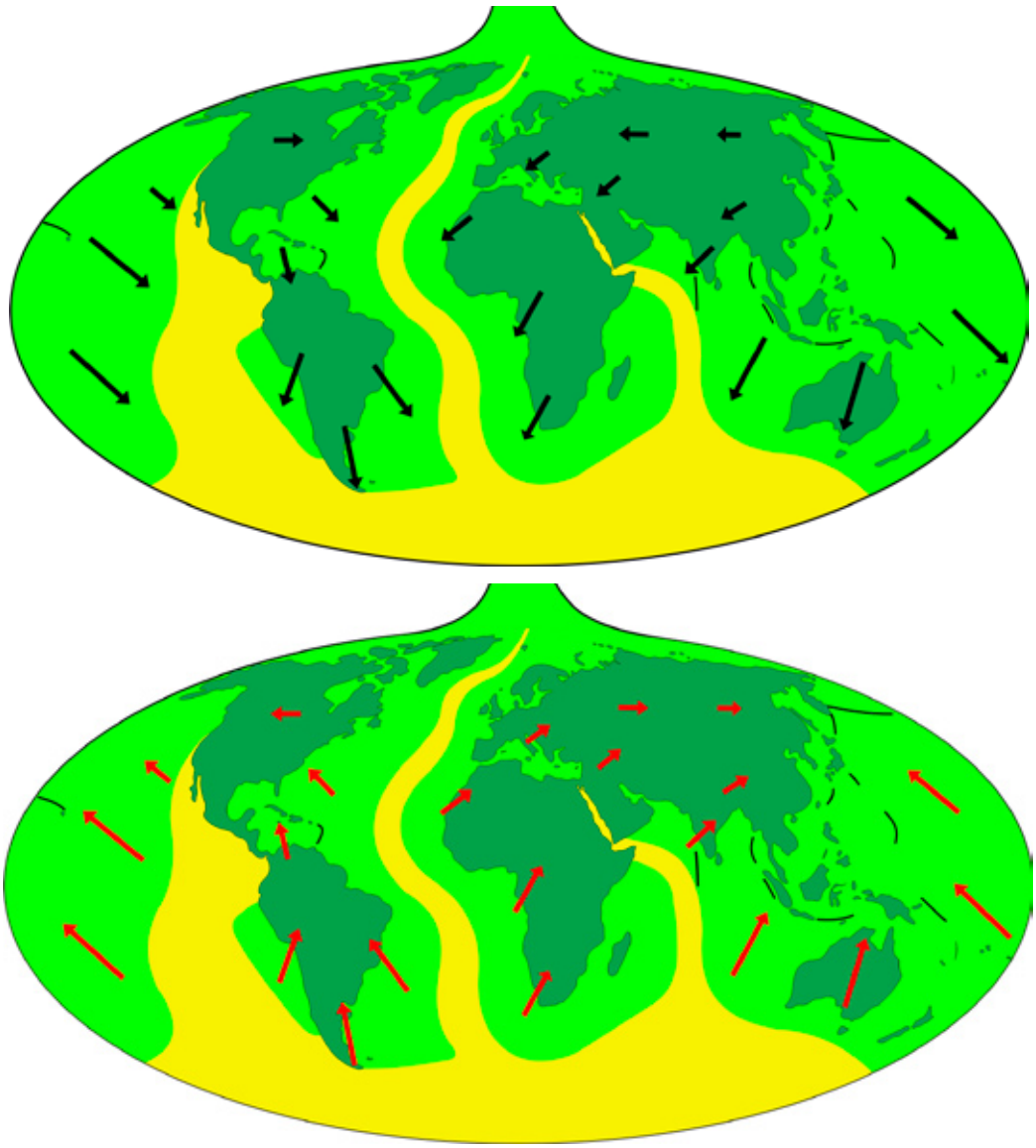
Fig. 37. **A** *– own model of the Arctic Paradox based on real geometry of continents and plates,* **B** *- division of the northern megaplate into three big fragments*

The northern megaplate is divided into three huge fragments: Eurasian-Pacific, American and African (Fig. 37B). Only the last of these three corresponds to a conventional plate.

14. Global apparent Eulerian motion of plates confirms Carey's Arctic Paradox

The expanding basement is shifting relative to plates as indicated by the black arrows (Fig. 38A).

Notice that the black arrows are unequivocally determined only by expansion of the basement and geometry (geography) of tears (rifts) in the lithosphere and their intensity. The northernmost latitudinal arrows are determined by the North Atlantic Ridge which is the only tear acting at high latitude. Its prolongation *i.e.* the Nansen Ridge reaches even beyond the North Pole. The southern arrows in Africa are small in comparison with southern range of the continent. That is because Africa is being torn from Eurasia along Red Sea and Carlsberg Ridge which diminishes the southern movement of the basement relative to it.



A

B

Fig. 38. **A** – *motion of the expanding mantle relative to the megaplate,* **B** – *apparent motion of parts of the megaplate relative to the expanding mantle*

Of course the movement of the lithosphere relative to the expanding basement is precisely opposite and presented by red arrows in Fig. 38B. These arrows must be treated on a non-expanding Earth as real ones, which is what produces the Arctic Paradox. This is the case with plate tectonics and contemporary space geodesy.

As is seen the arrows correspond very precisely to the arrows in Figs. 31 and 32. Thus, plate tectonics geodynamics recorded in the NNR reference frame proves in fact the process of the expansion of the Earth.

The collisions and contractions marked by the red arrows in Fig. 38B are only fictitious. In the frame of plate tectonics they are treated as real processes.

15. Attempted rejection of expanding Earth by space geodesy using Eulerian calculations – a circular argument

Space geodesy is a younger discipline than plate tectonics. The latter started towards the end of 1960s. The former established the first global geocentered ellipsoid GRS80 (Geodetic Reference System) as a global reference frame only in 1980. Prior to that, geodesy used only local ellipsoids pinned to the geoid at chosen points such as Potsdam for Western Europe and Pulkovo for the European communist countries. Subsequently space geodesy began to construct more precise mobile reference frames taking into account the motion of lithospheric plates. Thus the mentioned series of ITRFs appeared. The first was ITRF-89, *i.e.* two decades after plate tectonics appeared.

Of course the ITRFs are based on the supposed Eulerian motions. Then in an opposite way the space geodesy geodynamics (*i.e.* global plans of plate motion) is also calculated using Euler's theorem. In this way the Eulerian plate motions became for space geodesists something like a fundamental law of pure physics independent of any theory of Earth evolution. With this misguided approach the Eulerian (Morgan) calculations, which are tantamount to the hypothesis of a non-expanding Earth, may be used for checking the expansion of the Earth! Such a strange approach is presented in the paper by Wu *et al.* (2011). Their calculations are based on ITRF-2008 and use the rotation (Eulerian) vectors of 15 major plates which, of course, are mutually moving apart but also collide. The authors obviously consider plate tectonics an established fact and logically prior to any evaluation of possible

expansion of the Euler sphere. They calculated that any such expansion (in fact the expansion of the plate tectonics model, not the real Earth), is very small – the rate of the radius change of the Euler sphere (erroneously equated with the real Earth) must be lower than 0.2 mm per year.

The whole calculation is based on a deep misunderstanding and represents a spectacular circular argument. Testing the expansion of the Earth cannot be based on Eulerian motions of lithospheric plates which are specific feature of the non-expanding Earth hypothesis. Speaking more vividly – testing the reality of the heliocentric system cannot be based on the assumption that the geocentric system is true.

In fact there are several independent proofs of the significant expansion of the Earth. Some of them were presented in this paper. Four of them are presented in another paper (Koziar, 2004; www.wrocgeolab.pl/handbook.pdf).

So is with the rate of the Earth radius expansion. In fact the rate is about two orders higher (between 2.0 and 2.5 cm/year) than the acceptable one presented in Wu *et al.* (2011) paper. Interesting is that this high rate of expansion can also be deducted from space geodetic data. I presented both set of results, based on geodetic and geological data, in another paper (Koziar, 2011 – www.wrocgeolab.pl/geodesy1.pdf). They are reproduced here as Tables III and IV).

Table III. Present rates of the growth of the Earth's radius obtained by space geodesic methods

Author	Year	Rate [cm/yr]	Method
Blinov[1]	1987	2.43	Doppler Surveying (general uplift)
Carey[2]	1988	2.08 ± 0.8	SLR (chord analysis)
Maxlow[3]	2000	>1.8	VLBI (general uplift)
Koziar[4]	2011	>1.0	VLBI (fictitious baselines contraction)

[1)] correct interpretation of the results obtained by Anderle and Malyevac (1983)
[2)] W.D. Parkinson's calculations
[3)] correct interpretation of the results obtained by Robaudo and Harrison (1993)
[4)] correct interpretation of the results obtained by Heki et al. (1989)

Table IV. Present rates of the growth of the Earth's radius obtained by geological methods

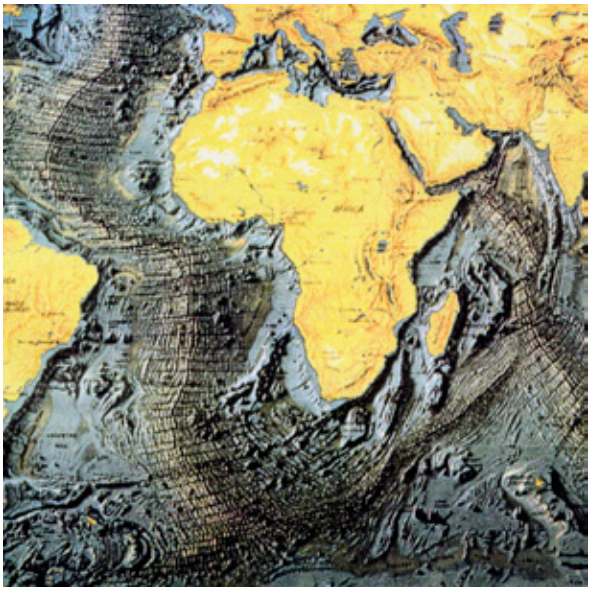
Author	Year	Rate [cm/yr]	Method
Koziar	1980	2.59	Increase in the Earth's surface area (Phanerozoic)
Blinov & Schuber	1984	≅ 2.0	Increase in the Earth's surface area (Cenozoic)
Maxlow	2002	2.2	Increase in the Earth's surface area (from the Archean)
Koziar[1]	1996	2.7	Increase in the Earth's circumference
Koziar	2011	>2.0	ratio of the lengths of Atlantic Ridge and the shore of Africa
[1)] correct interpretation of the result obtained by Le Pichon (1968)			

16. Broader geodynamic surroundings of the expanding Indian Ocean triple junction

This surroundings will be described in counter clockwise direction, starting from the African plate.

a. Expanding African plate

The most striking and crucial geotectonic feature of our globe is enlargement of the outline of the African plate relatively to its initial shape *i.e.* relative to the contour of the African continent (Fig. 39A)



A

B

C

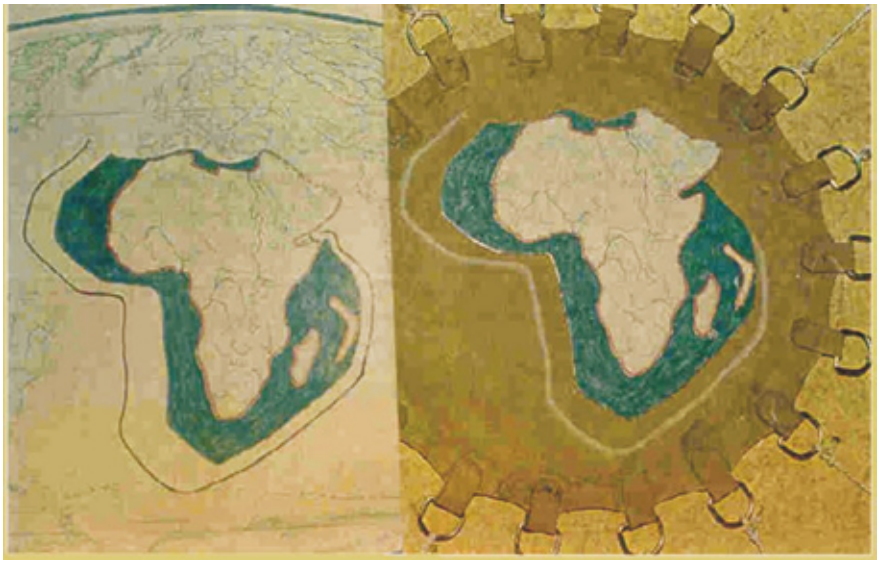


Fig. 39. *Modelling of the expansion of the African plate (explanation in text)*

The border of the plate is composed of segments of oceanic ridge and active transform faults. Its indisputable enlargement is not being explained in frame of plate tectonics. What is more, it is inexplicable in this frame. Whereas it is easily explained on an expanding Earth. This was already pointed out by Carey (1958) and Heezen (1960). The process of enlargement may be modelled on the same type of device (Fig. 21C) as the expansion of the Indian Ocean triple junction. Due to the limited stretchability of the rubber disc, the model of the starting plate includes some older oceanic lithosphere (green colour – Figs. 39B and C).

The model is placed on the rubber disc and then outlined with chalk (Fig. 39B). Then the rubber disc is stretched (Fig. 39C – right). The plate contour is enlarged and this is compared with the real contour of the present African plate (Fig. 39C – left). Before stretching the model was weighted in its NE area to reflect cohesion of the African plate with the Eurasian one. In other words, Eurasia pulls Africa to the NE.

It must be pointed out that the northern part of African plate expands too because Mediterranean Sea is in fact a divergent structure (Koziar and Muszyński, 1980; Koziar and Jamrozik, 1985 – www.wrocgeolab.pl/Carpathians.pdf).

b. Expanding Antarctic plate

Modelling of the expansion of the Antarctic plate is done in the same way. Fig. 40A shows the initial situation. The modelled expanded Antarctic plate contour (Fig. 40B – right) is compared with the real contour of the present Antarctic plate (Fig. 40B – left).

A

B

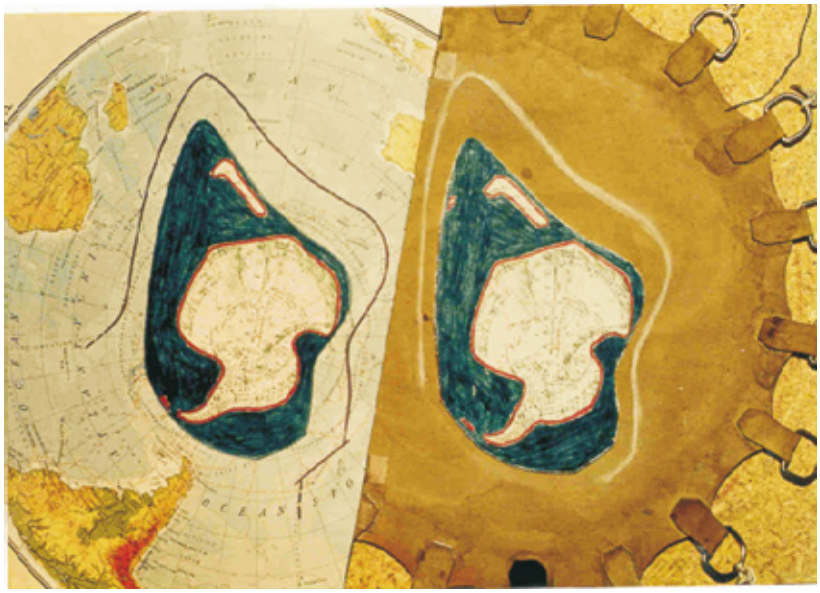


Fig. 40. *Modelling of the expansion of the Antarctic plate (explanation in text)*

The modelled expansion of both plates was presented in my early paper (Koziar, 1980 – www.wrocgeolab.pl/floor.pdf).

c. Divergence outside the Indo-Australian plate

The Indo-Australian plate does not expand in so spectacular way as the former two. What is more its NE boundary is entangled into plate tectonics convergent interpretations which are: the convergent interpretation of the development of intracontinental fold belts and an analogous interpretation of the development of island arcs. In fact both structures are divergent with a tension-diapiric-gravitational mechanism (Koziar and Jamrozik 1985 – www.wrocgeolab.pl/Carpathians.pdf; Koziar, 2005; Koziar and Jamrozik, 1994 – www.wrocgeolab.pl/margins1.pdf; Koziar, 2003 – www.wrocgeolab.pl/margins2.pdf.

Thus there is a wide area of tension between the India craton and Angara shield (Fig. 41) and also wide areas of tension connected with oceanic trenches (Fig. 42).

Fig. 41. *Mutual moving apart of India craton and Angara shield (Koziar, 2005)*

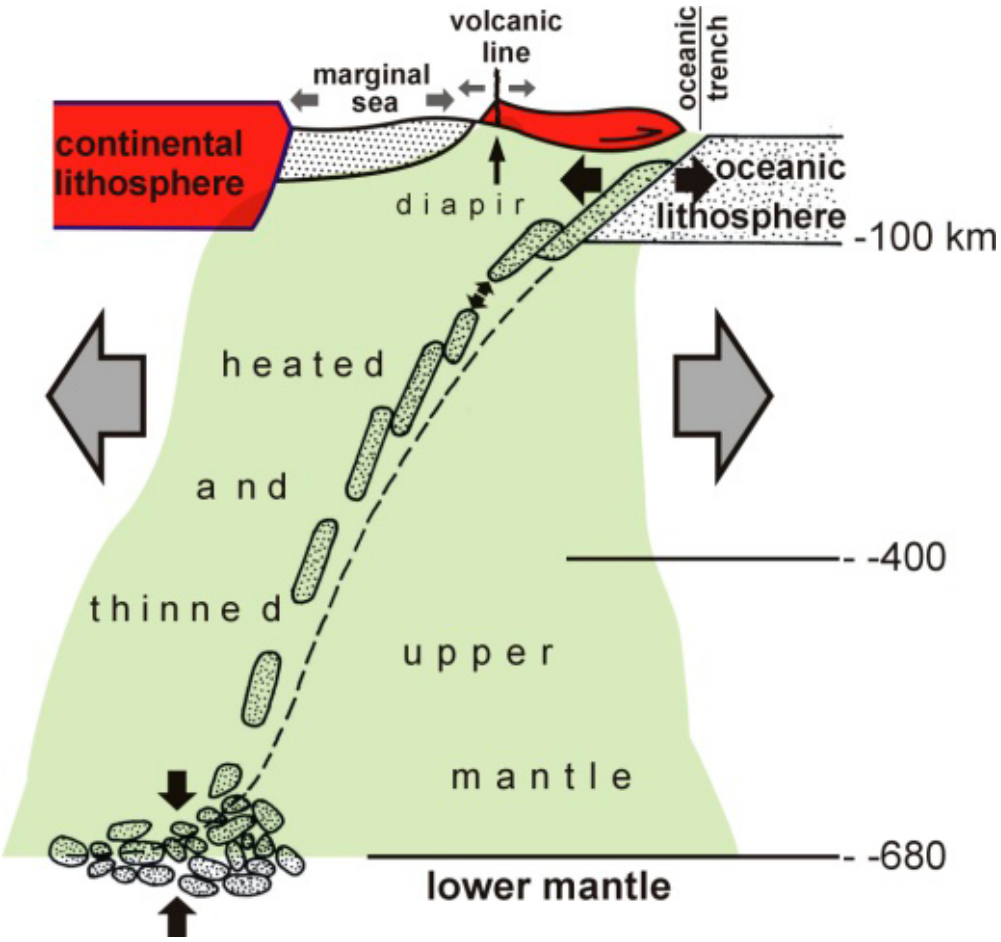


Fig. 42. *Tensional development of island arc (Koziar, 2003)*

In this way the Indo-Australian plate is expanding too (Fig. 43).

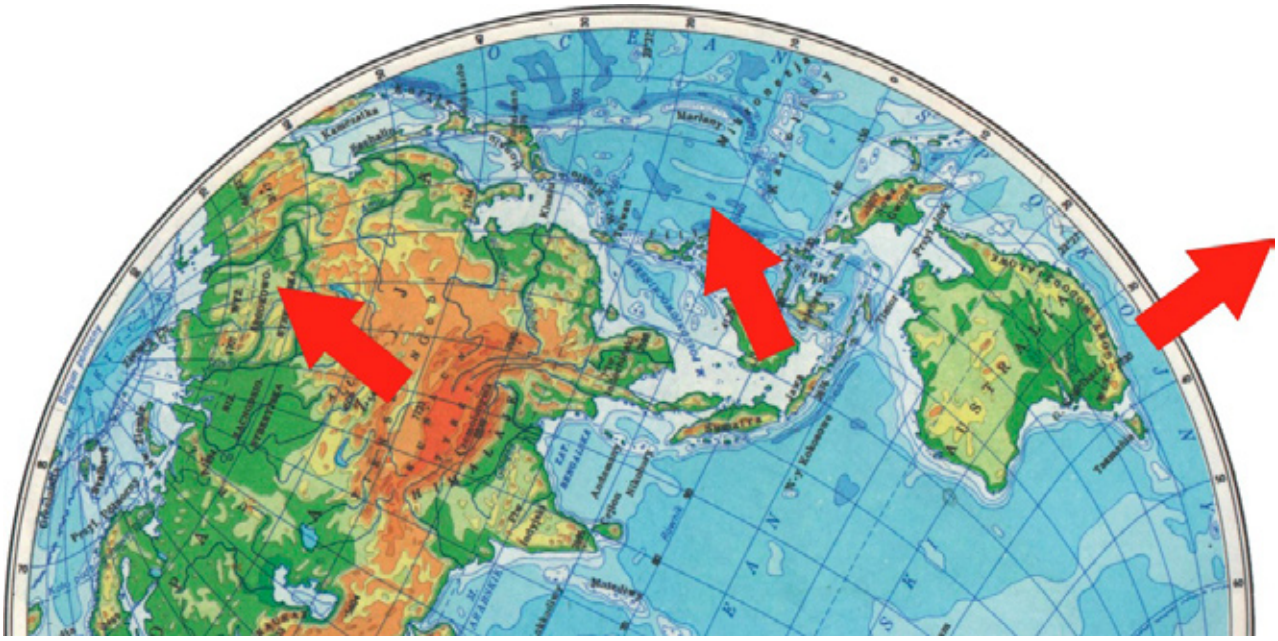


Fig. 43. *Expanding Indo-Australian plate (explanation in text)*

d. Expanding Pacific

Further to the east of the Indian Ocean triple junction there is the expanding Pacific (Fig. 44).

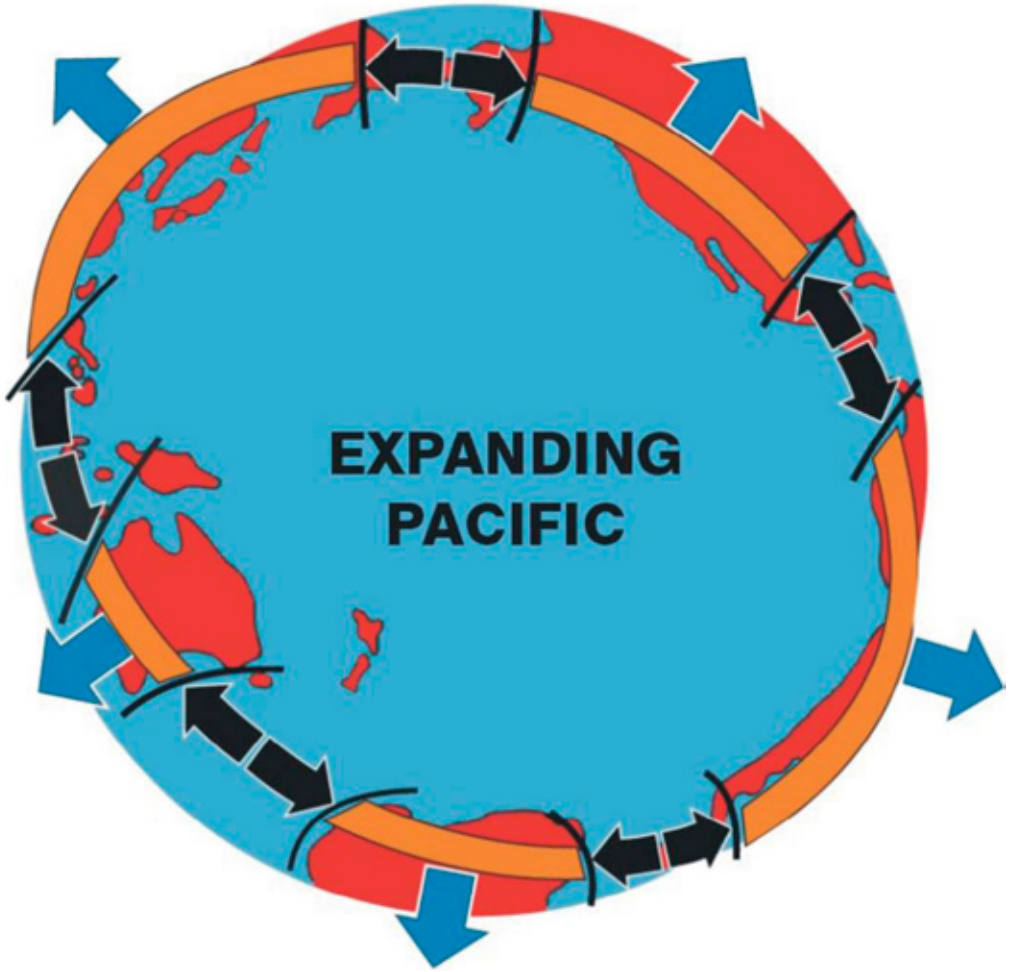


Fig. 44. *Expanding Pacific after Koziar (1993) –* www.wrocgeolab.pl/Pacific.pdf .

The expanding Pacific, which is implied by the divergent development of all intercontinental gaps along the Pacific perimeter, is an independent proof of the expansion of the Earth. The proof was formulated by Carey (1958, 1976). The most crucial for the proof is the divergent development of the southeast Asia – Australia gap, pointed out in Fig. 25.

e. Expanding all diffuse plate boundaries

From all that is said above, it appears that all diffuse boundaries are divergent. These were put together globally by Gordon (1998) and taken from the Internet in coloured version (Fig. 45). I removed only the arrows of alleged subduction at oceanic tranches.

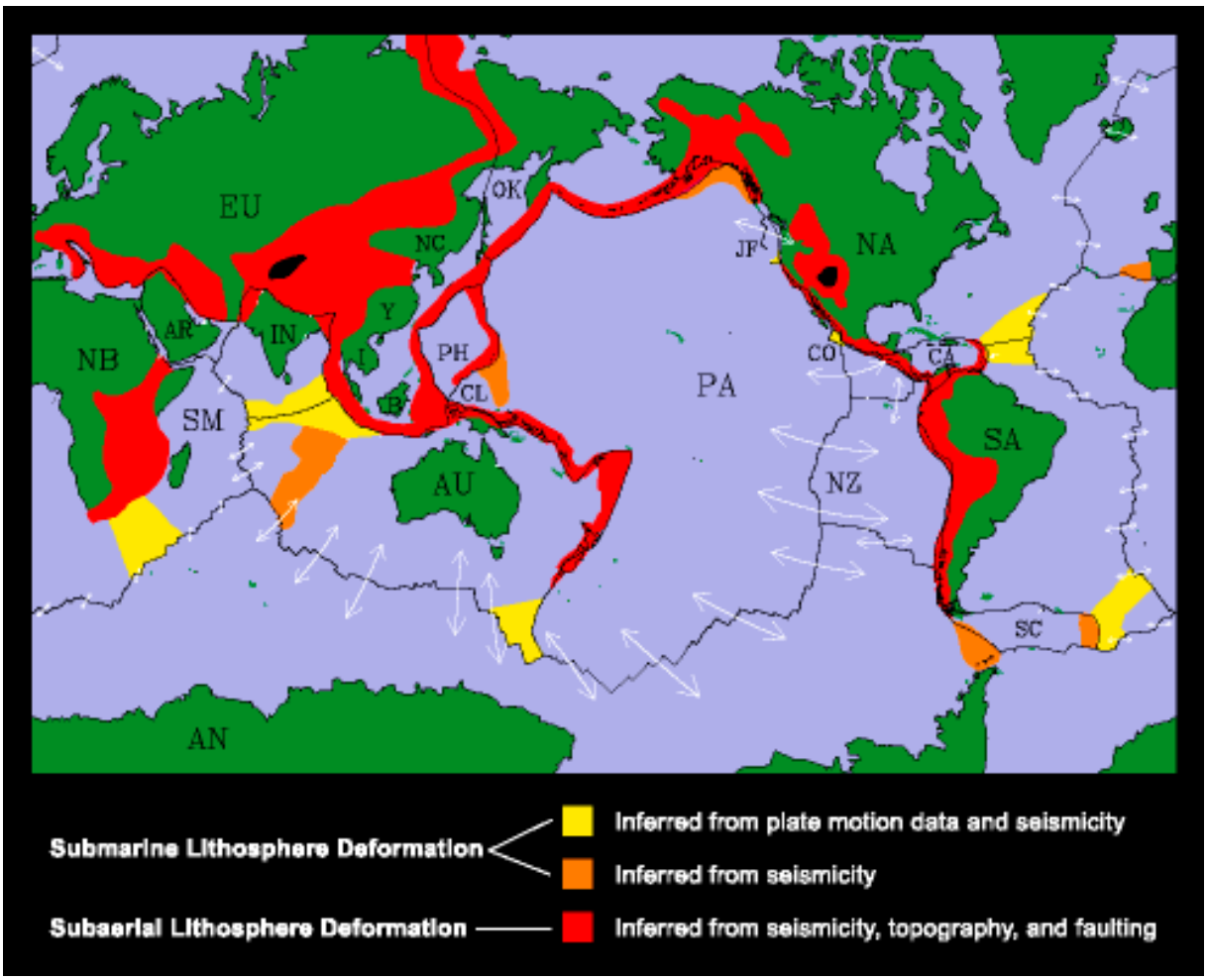


Fig. 45. *Global distribution of all diffuse plate boundaries (according to Gordon, 1998 – Internet version) with arrows of alleged collision removed.*

Thus all diffuse boundaries (which covers about 15% of the Earth surface) contribute slightly to global annual increment in the Earth surface area which results mainly from the uncompensated spreading of the ocean floor.

The resulting has only a logical nature (implication). Causally (physically) all these processes result from huge expansion of the Earth interior.

17. Interplate Carey's sphenochasms instead of Eulerian openings

One may wonder, why the divergent movements of plates on an expanding Earth can closely resemble the situation described by Eulerian theorem while actually having a different origin. This question is easily answered: because the ripping of the envelope of an expanding spherical object (Fig. 46A and B) is similar to the Eulerian model of rifting (Fig. 47). The later can be compared to cat's pupil mechanism (Dietz and Holden, 1973) – Fig. 47 – left, or helmet visor mechanism – Fig. 47 – right.

A

B

Fig. 46. **A** – *shabby soccer ball model of rifting on the expanding Earth,* **B** – *Pacific with removed post-Paleogene lithosphere.*

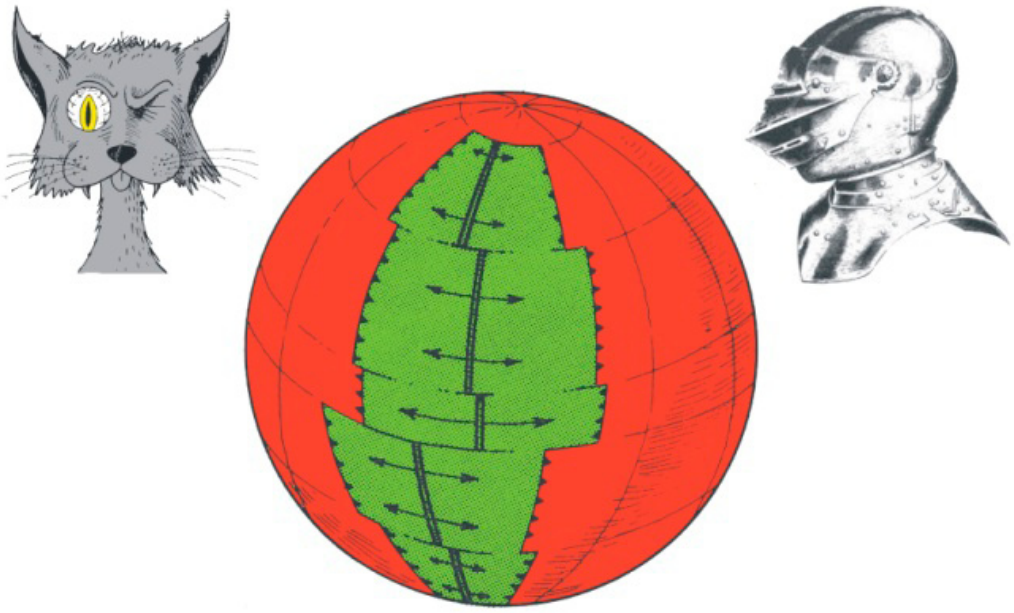


Fig. 47. *Eulerian model of rifting on a non-expanding Earth (Dietz and Holden, 1973 – centre). The model can be compared to cat's pupil motion – left (Dietz and Holden, 1973) or helmet visor motion – right (Internet).*

Long before plate tectonics appeared, Carey (1958) introduced to geotectonics a new class of structures he called "sphenochasms". After his definition (p.193) the sphenohasm is:

> *the triangular gap of oceanic crust separating two cratonic blocks with fault margins converging to a point, and interpreted as having originated by the rotation of one of the blocks with respect to the other.*

The sphenochasms can be of very different size and not necessary that they should be filled with oceanic crust. They can also be filled with sedimentary basin formations (exogenic filling) or by magmatic formations (endogenic filling). A sphenochasm consists of a V-shaped gap, arms and a vertex (Fig. 48).

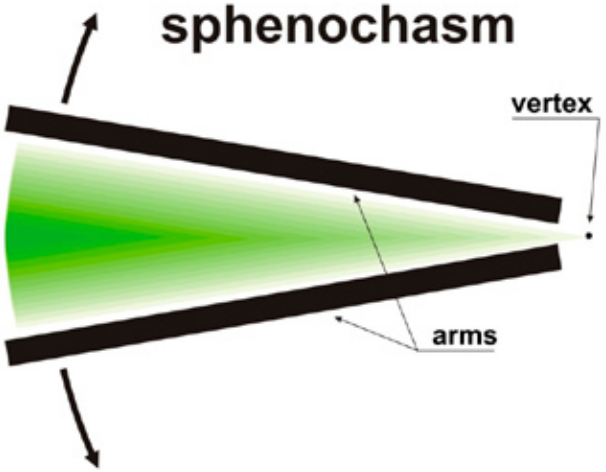


Fig. 48. *Carey's sphenochasm (explanation in text)*

The sphenochasm concept is also very useful for interpretating the tensional development of the lithosphere within continents. However, the larger sphenochasms are typically filled with oceanic crust and the largest of them are "interplate sphenochasms". Vertexes of such interplate sphenochasms are wrongly interpreted in plate tectonics as "Eulerian poles".

In case of the largest sphenochasms the position of the vertex is not stable because the tensional ripping (rift) propagates, as is seen in Fig. 46A.

Propagation of the oceanic ridges is a confirmed phenomenon and itself contradicts Eulerian plate motion.

18. Conclusions

Geology and subsequently space geodesy were trapped, a half century ago, in the plate tectonics paradigm based on supposed Eulerian motions of lithospheric plates.

In this paper the Eulerian motion of tectonic plates has been falsified. The right alternative to the wrong plate tectonics paradigm is the expanding Earth. However this time the expanding Earth is no paradigm but a real phenomenon.

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Part Two

Plate tectonics: A theory founded on circular arguments

A supplement to
Falsification of the Eulerian motion of lithospheric plates

I. Some historical remarks connected with contemporary geotectonics

1. Sea floor spreading and the expansion of the Earth

At the end of the 1950s, two discoverers of sea floor spreading, Samuel W. Carey and Bruce C. Heezen, connected the discovery with the enormous expansion of the Earth (see www.wrocgeolab.pl/priority.pdf). Carey also delivered the first proofs of the expansion: the Pacific Paradox (growth of the Pacific) and the lengthening of plate borders. But the very phenomenon which disclosed the expansion to him there were artificial "gaping gores" which appeared at the attempts of reconstructions of the lithosphere on the present-size Earth. Such gaping gores are crucial to the problem presented in the former paper.

2. Blind alley of geology

Then geology was directed into a blind alley first by Robert Dietz and Harry Hess at the beginning of the 1960s and subsequently, at the end of the decade, by Jason Morgan, Dan McKenzie and Xavier Le Pichon. These latter authors are considered the "founding fathers" of plate tectonics.

The first authors connected the spreading of the ocean floor with hypothesis of convection currents and, of course, subduction of the ocean floor.

The second group of authors founded geotectonics (and almost all geology) on Euler's theorem, imposing Eulerian motion on all lithospheric plates. However the authors who first introduced the theorem to geotectonics where E.C. Bullard, J.E. Everett and A.G. Smith (1965) in their computer attempt of reconstruction of the Atlantic (Bullard's fit) – see the next paragraph.

Each of these groups of authors have based their concepts on the constant-size-Earth assumption without bothering to prove it, apart from one attempted proof by Le Pichon. However a careful analysis of his "proof" actually supports one of several independent values of the annual growth of the Earth radius – circa 2.5 cm/year (see: www.wrocgeolab.pl/circle.pdf).

In the frame of plate tectonics several models have been constructed on its unproved assumption (first of all just the Eulerian plate motions and a model of subduction). These models began to play role of real processes, apparently confirming the starting assumption. However in this way plate tectonics developed only its very structure of a circular arguments (vicious circle) theory. The topic will be developed in the paragraph II.9 and part III.

3. Atlantic fit is Bullard's fit or Carey's fit? A real story of introduction of Euler's theorem to geology

The "Atlantic fit" is a geometrical fit of the borders of continents on both sides of the Atlantic Ocean. This fit was noted by many authors since the 16th century. But only Wegener used it (together with other arguments) for elaboration of the fully scientific theory of the opening of this ocean. However, as is known, Wegener's theory was rejected in the 1930s. The person most responsible for the rejection was the prestigious British mathematician, physicist, astrophysicist and geophysicist Harold Jeffreys. His main argument against Wegener's theory was the lack of convincing explanation of the cause of the mutually moving apart of the continents. By the way – after years – this moving appeared true (as a phenomenon) and causal criticism is methodically wrong. But this way of criticism became very popular in geology and is now the main argument against the expanding Earth.

However Jeffreys also pointed at alleged lack of a good fit between Africa and South America. In 1933 Carey made precise spherical reconstruction of the South Atlantic and knew that Jeffreys was wrong. Let us quote Carey himself (1988; p. 102):

> *In 1929 appeared Sir Harold Jeffreys's prestigious book, The Earth – quite the most authoritative treatise ever on the physics of the earth, following the tradition of Osmund Fisher and Lord Kelvin. However, Jeffreys was completely opposed to Wegener hypothesis, and in regard to the alleged fit of South America into the angle of Africa, he wrote:*
>
> *"On a moment's examination of the globe, this is seen to be really a misfit by almost 15^0. The coast along the arms could not be brought*

within hundreds of kilometers of each other without distortion. The width of the shallow margins of the oceans lend no support to the idea that the forms have been greatly altered by denudation and deposition".

And again Carey:

From many "moments" of accurate examination of this question, that I had done, I knew this statement to be incorrect. I considered that the matter was rather trivial, that the true position would be generally realized, and that this criticism would fade away. But Jeffreys's prestige was so great that most workers accepted his pronouncement as final. Jeffreys repeated the statement in the second edition of his book in 1952, and to rub salt on the wound. Dr. George Martin Lees (my former chief in the Anglo-Persian Oil Company), in his 1953 presidential address to the Geological Society of London, listed this as one of his three crucial reasons for rejecting the Wegener hypothesis. So I sent Lees my stereographic projections of two decades earlier, together with the comparisons I had made on the spherical table (Fig. 11), proving that Jeffreys's statement was false. I added that 'whether the continental drift hypothesis be true or false, this argument should never be used against it again.' I asked Lee to arrange publication of this rebuttal, which he did.

When I went to England in the summer of 1960 as Tasmanian delegate to the third centenary of the Royal Society, Sir Edward Bullard invited me to lunch to discuss the Atlantic fit, which he then repeated with the aid of computer. The Atlantic match has since been known as the "Bullard fit" and adopted generally.

As I reported in the former brochure, the mathematical basis for Bullard et al.'s computer reconstruction of the Atlantic Ocean was Euler's theorem. Above is the real story of the introduction of this theorem into geology.

4. "North American geology has never been the same since"

In the aftermath of 1956 Hobart Symposium, Carey was invited to the USA by Chester Longwell as a visiting professor "to stir the American pot". His visit was realized in 1959-1960 academic year and started at Yale University, the stronghold of American fixism. Then Carey gave lectures in many other places (also in Canada) and was very successful at reanimating mobilism in North America. Here's how he relates it (p. 118):

In Yale I delivered complete courses in structural geology and global tectonics. But I also lectured in many other American universities, mostly under the American Geological Institute Visiting International Scientist Program: Brown, Columbia, Harvard, Wesleyan University, Lehigh, Princeton, Duke, North Carolina, Louisiana State. St. Louis, University of Cincinnati, and Ohio State, as well as Toronto, Western Ontario, McGill, Calgary, and British Columbia in Canada. As with Mathew's sower, some, some seeds did fall on fertile soil and took root, only to be choked off later when subduction weeds grew rank. /..../

Professor Walter H. Bucher, the patriarch of American tectonicists, who had been stung by my heresies, invited me to confront him in a debate at Columbia. The Schermerhorn Theater was packed as geologists and geophysicist gathered from far afield, and a most memorable night resulted. Geophysicists and geochemists marshaled behind the ghost of Kelvin to reject as really impossible the geological assault, and withdrew checked, but not mated.

Apart from Yale, my deepest involvement was with Princeton where I lectured several times in late 1959 and early 1960, including discussion of oroclines, the paleomagnetic evidence of large intercontinental movements, and ocean-floor growth by repeated insertion of paired slices at the mid-oceanic ridges as detailed in the Hobart Symposium. /.../

The campaign culminated with a special session on continental drift sponsored by the Society of Economic Paleontologists and Mineralogists at the annual meeting of the American Association of Petroleum Geologists at Atlantic City on April 25, 1960. I was lead speaker, and with me on the panel were Keith Runcorn, Ken Caster, and William Gussow. The hall was packed, even the aisles and the walls. After the formal papers from the panel, the questions and discussion continued until long after midnight with few if any leaving, until the chairman had to terminate the meeting.

Carey reported also that years later one of the witnesses of these events (John Rodgers) commented, that after them "*North American geology has never been the same since"* (p. 118).

Carey really did break through American fixism and American geology changed but not in the correct direction, pointed by him.

5. Misleading role of paleomagnetic tests

The first paleomagnetic tests on possible changes of the Earth's radius were formulated by the Hungarian geophysicist and expansionists Laszlo Egyed in 1960 and 1961. The tests led to whole series of misinterpretations and discussions described by me in another paper (Koziar, 1991; www.wrocgeolab.pl/research.pdf) in a chapter under the same title as this paragraph. The most fatal impact on the perception of the expanding Earth resulted from the introduction of Ward's erroneous method in 1963. Carey (1976) and independently Chudinov (1984) demonstrated that this method always shows constant Earth radius independently of data. However plate tectonicists ignored this result, being already convinced that the Earth is not expanding.

6. Some strange circumstances at the starting point of plate tectonics

The real founding father of plate tectonics is Jason Morgan. However the first published paper on it was by Dan P. McKenzie (and Robert L. Parker, who played only a secondary role, developing oblique Mercator nets). How did this happen?

Some interesting light on the circumstances of the birth of plate tectonics has been thrown by Le Pichon's 1991 paper, written almost a quarter of century after the crucial year 1967.

Morgan presented his elaborated concept of plate tectonics in April 1967 at the meeting of the American Geophysical Union (AGU), attended also by Le Pichon. His lecture drew little attention from the audience, including Le Pichon, who only became involved in the idea after reading the manuscript which Morgan sent after his lecture to about ten persons. Le Pichon himself started to work on this concept only later with full consciousness of Morgan's priority and began cooperate with him directly from early September 1967. Morgan sent his manuscript also to H. William Menard, an outstanding investigator of the Pacific Ocean, from the University of California (the Scripps Institution of Oceanography). The manuscript did not make much impression on Menard either. On the contrary, he discussed it critically with his students.

McKenzie attended the AGU meeting too and the session with Morgan's scheduled lecture. However, by his account, he left the session just before Morgan's talk. In June 1967 McKenzie joined the Scripps Institution, where

Morgan's concept was already known, and started to work on plate tectonics inspired only (as he insisted) by Bullard *et al*.'s 1965 paper, mentioned above.

Le Pichon wrote (p. 4):

> *It is astonishing that Mc Kenzie*[1] *twice so nearly missed the opportunity to learn about Morgan's model. The first occasion was when he left the room just before Morgan's talk on April 17. The second occasion was when Bill Menard, who had received the extended outline of the April communication in late April, failed to mention it to Mc Kenzie although they "talked a great deal" together "about plate tectonics" (quote from the letter of Mc Kenzie)*[2] *and although Morgan's "manuscript had circulated among Menard's students" and had been "discussed" by them (quote from the book of Menard).*

Morgan started to prepare his manuscript for publication and next sent it to the Journal of Geophysical Research at the end of August 1967. The JGR sent the manuscript for review to Menard who received it at the beginning of September and showed it to McKenzie. They agreed that McKenzie should write up his version quickly and publish it.

McKenzie wrote (in Le Pichon's paper, p. 3):

> *I had talked a great deal to Bill Menard about plate tectonics and had convinced him that it worked for the Pacific. JGR sent him Jason Morgan's paper to referee and, I suspect because of our conversation, he was very critical of it when he showed it to me. I asked him what I should do and he said to go ahead and publish, which we [together with R.L. Parker – JK] did as everyone knows.*

Of course, everyone knows their publication but not its background, until Le Pichon's 1991 paper. And even after that, a group of people knowing and remembering Le Pichon's paper is very small.

After the mentioned talk with Menard, McKenzie and Parker wrote quickly a short paper on plate tectonics applying it to the Pacific, and sent it to Nature. Meanwhile Menard delayed reviewing Morgan's paper (which, by the way, was better than McKenzie and Parker's) until the latter was published in Nature on December 30, 1967. Then Morgan's paper had to be accepted by JGR and published, but only in March 1968.

In this way McKenzie gained priority in plate tectonics.

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1 Le Pichon's spelling of McKenzie's name.

2 Parantheses by Le Pichon.

The role of Menard in this story is rather clear. The paper by McKenzie and Parker was ascribed to his institution and increased its prestige. Of course it was dishonest but is pretty common in today's market economy of science.

The whole story has a still more astonishing aspect, pointed out by Le Pichon. He wrote (p. 4):

> *To me, the most surprising part of it is that Mc Kenzie confined himself to discussing the plate kinematics of the Pacific-America plate boundary based on earthquake fault plane solutions and did not consider the kinematics of the Atlantic ridge. In the equatorial Atlantic, good data on transform faults (Heezen and Tharp, 1965) and on earth-quake fault plane solutions (Sykes,1967) were available and the opening of the Atlantic Ocean is the subject of the fit of Bullard et al. (1965) which gave the initial intuition to Mc Kenzie.*

A simple explanation of this "most surprising part" of the story is that otherwise McKenzie's model would not differ much from Morgan's and the thesis of an independent origin of the former would be quite unbelievable. Even so, it remains unbelievable after Le Pichon's description of the inception of plate tectonics. Le Pichon commented on the story in a very diplomatic way, which is understandable as he is one the of the three "founding fathers" of plate tectonics. However I have no reason to follow his way.

There is also another very meaningful fact. Neither Morgan nor Le Pichon cited McKenzie and Parker's paper from the end of 1967 in their subsequent, fundamental 1968 papers on plate tectonics. This is despite the fact that both of these founding fathers knew very well the paper of the "first" founding father.

Two important conclusions arise from the story.

1. Without unhealthy rivalry, the founding fathers of plate tectonics would be more able to understand its falseness. Morgan and Le Pichon cooperated mutually correctly, but McKenzie not. After publication of McKenzie and Parker's paper, Morgan's paper was published urgently, probably without careful reviewing. Had there been full cooperation of all Founding Fathers, acting without useless hurry, they might have been able to find a fault in Morgan's procedure of "proving" the alleged correctness of the Eulerian motions of lithospheric plates.
2. It is very good in science if a discovery is made by two or more independent discoverers. It is especially important in case when the discovery is tentative and requires subsequent justifications. In this

situation independence of discoverers speaks for the objectivity of the discovery. In the case of plate tectonics such independent discovery of its fundamentals is more apparent than real. What in fact are rather negative circumstances surrounding its origins pretend to be positive ones.

II. Some methodological remarks connected with contemporary geotectonics

1. Assumptional fundament of plate tectonics

This fundament is not the Euler theorem but, as mentioned at the beginning, the constant-size-Earth assumption. Morgan and McKenzie adopted the assumption tacitly and only Le Pichon did so explicitly. But it was only an episode of openness and only at the starting point of plate tectonics. Let Le Pichon speak (1968; p. 3674):

> *If we assume that the earth is spherical and that the length of its radius does not change with time, we can then proceed to the complete determination of the movement of the major crustal blocks relative to each other.*

And other quotation (p. 3673):

> *If the earth is not expanding, there should be other boundaries of crustal blocks along which surface crust is shortened or destroyed.*

This reasoning exerts deep and negative impression on today's students, opening their eyes on the real character of plate tectonics. So praise be to Le Pichon for stating it clearly. Le Pichon is also alone in having attempted to prove the assumption but without much success (see the mentioned paper: www.wrocgeolab.pl/circle.pdf). The other two founding fathers did not mention this assumption at all. Nor did they care about proving it. Plate tectonicists are also extremely resistant against all proofs of the expansion of the Earth. They simply do not understand what is being talked about. Both phenomena result from today's understanding of every scientific theory as a so called "paradigm". This problem is discussed in paragraphs II. 4-5, while beneath the proofs of the expansion of the Earth are enumerated.

2. Factual fundament of expanding Earth

The fundament is not based on assumptions but on proofs of expansion. They are listed beneath.

1. Growth of the Pacific (Carey's test), Carey (1958, 1976)
2. Elongation of plate boundaries, Carey (1958, 1976)
3. Mutual moving apart of hot spots, Stewart (1976)
4. Deep mantle roots of plates, Carey (1983), Kremp (1990)
5. Carey's "gaping gores" (artificial openings at underestimated curvature of the globe), Carey (1958), Van Hilten (1963)
6. Carey's Arctic Paradox, Carey (1976)
7. Ripper's and Perin's growing perimeters of the Earth, Ripper (1970); Perrin (1992, 2003).

All these proofs are independent. They start from quite different facts and all prove the same process – the enormous expansion of the Earth. Thereby they also prove, in very different ways, the fallacy of the base assumption of plate tectonics, that is its not-expanding-Earth assumption.

All these proofs have been invented by other authors. I am only trying to give them more elaborated form and put them together, Koziar (2004; www.wrocgeolab.pl/handbook.pdf, 2014a; www.wrocgeolab.pl/circle.pdf, and present paper).

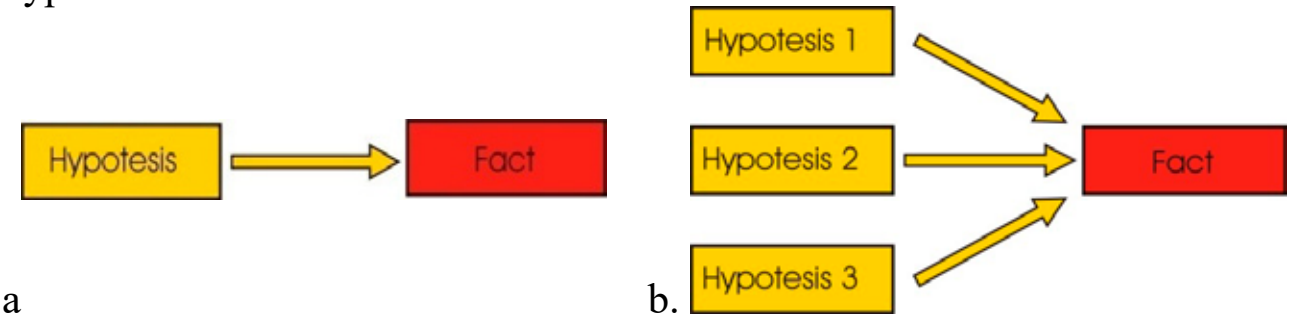
For good understanding these proofs (and proofs as such) it is necessary to distinguish between a proof and only a confirmation of a hypothesis

3. Difference between confirmation and proof of a hypothesis

The difference depends on the direction of logical implication between a hypothesis and a fact.

a. Confirmation of a hypothesis

If a fact results from a hypothesis (Fig. 1a) then the fact only confirms the hypothesis.



a b.

Fig. 1. *Confirmation of a hypothesis (explanation in text)*

The fact can also result from other hypotheses (Fig. 1b) and they all are confirmed by it. By the same token, the fact does not prove any one of them. The hypotheses are only sufficient conditions of the fact.

b. Proof of a hypothesis

If a hypothesis results from a fact (Fig. 2a) then the fact proves the hypothesis.

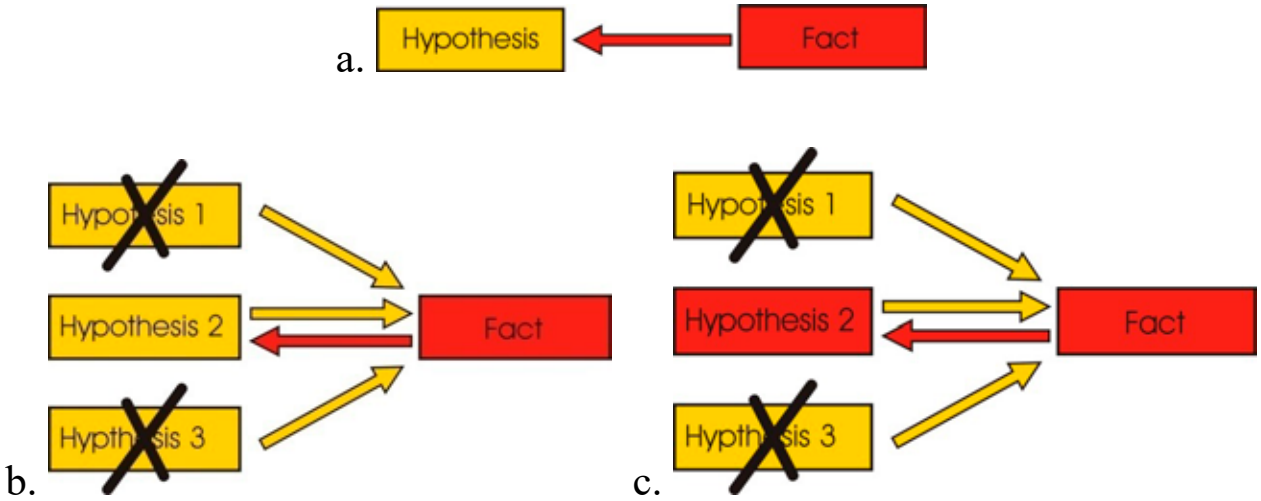


***Fig. 2**. Proving of a hypothesis (explanation in text)*

By the direction of implication the fact eliminates all other hypotheses (Fig. 2b) and in that the proof consists. The hypothesis becomes the necessary condition of the fact and in the real world the hypothesis becomes also a fact (Fig. 2c). On the rule of mutual implications the fact and the hypothesis becomes mutually unequivocal.

In the preceding paragraph it was shown that the expansion of the Earth results from quite different facts. Thus each time it is a proof and all the proofs are mutually independent.

Each proof of the expanding Earth has the structure given in Fig. 2c. In all the proofs the expanding Earth is the implication of different facts as also a fact.

Now, I will demonstrate why the proofs of the expanding Earth are not very effective in today's not very scientific practice.

4. Problem of cognitive relativism. The concept of a paradigm

From Newton's time up to Einstein's scientists believed that Newton's dynamics is true. Then it appeared that Einstein's theories describe the real

world better. It meant that Newton's dynamics was not true in an absolute sense. Shortly after Einstein's achievements Niels Bohr treated the quantum dynamics similarly as Andreas Osjander treated the Heliocentric System in the introduction to the first edition of the Copernicus work "*De Revolutionibus ...*":

> *there is no need for these hypotheses to be true, or even to be at all like the truth; rather one thing is sufficient for them – they should yield calculations which agree with the observations.*[3]

These important changes led to conclusions that an absolute truth does not exist or if even does, it is unavailable. In other words the changes led to cognitive relativism. Then they led to modern theories of the development of science. The two most important were elaborated by Carl Popper (1963) and Thomas Kuhn (1962). They differ in details[4] but the main idea is the same. According to each author a given theory is only better or worse than any other (applied to the same problem) but never true. So no theory can be proved, whereas every one can by falsified.

Kuhn introduced the term "paradigm" which is not very precise and can be applied to both: a concrete theory in a chain of false theories and the whole mental culture connected with it. We will apply the term only to theories in Popper-Kuhnian chains of false theories, though Popper himself did not use it.

A very harmful effect results for science from the concept of the paradigm and its unjustified (see the next paragraph) application to all scientific theories. Because allegedly no theory can be proved, so every procedure of proving a given theory is some forbidden and unintelligible activity. It can be understood as only a procedure of deception.

In normal (not relative) science and practical activity (for example criminology) the more proofs the better. In Popper-Kuhnian science the more proofs the worse. The Greek's three proofs of the sphericity of the Earth

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[3] C. Popper's (2002, p. 131) translation.

[4] Popper claims for very quick falsification of every theory. Kuhn is more merciful, seeing some benefits of them. Popper's infinite sequence of false theories leads after all to the truth which is however unavailable. Kuhn's sequence is divergent. Both authors were Darwinists in different sense. Popper's fierce falsification of the worse theories is a Darwinian fight for life of better theories. Kuhn's sequences of false theories do not lead to the truth similarly as Darwinian evolution does not lead to any definite goal.

should be understood as only a threefold fraud. Seven proofs of the expansion of the Earth, presented above, should be understood as a sevenfold fraud.

This is an important reason why the quoted proofs of the expansion of the Earth made almost no impact on geologists, infected by cognitive relativism. I have met even with the opinion that the proofs of Earth expansion are only "informatics noise" or "models" or that they will certainly be falsified by some facts discovered in the future. Thus they can be treated as already falsified.

The infection was transmitted to geology mainly via plate tectonics theory which announced itself as a paradigm. Thus I decided to falsify this paradigm in this paper, because the language of falsification is more understandable today for many geologists, than the language of proving anything.

5. Expanding Earth and a majority of scientific theories are not paradigms

In fact, majority of scientific theories are not paradigms and can be proved forever. I lectured this problem at my Institute in 2006 and recently (March 2017) at the National Geological Institute Lower Silesian Branch. The lecture was entitled: ***On the contact of geology and defective philosophy. A problem of cognitive relativism*.**

The crucial rescue operation from the total relativism in science is to distinguish two kinds of theories:

1. Theories which formulate laws which rule some phenomena
2. Theories which predict or prove the **existence** of some phenomena

Both Kuhn and Popper elaborated their cognitive relativism on the cases of the first kind of theories and maybe theories of this kind correspond to the sequences of paradigms.

A quite different situation arises with theories of the second kind which are more numerous and should be ranked in the first place in science. The theses of such theories can be well proven and become indisputable facts. We have a tendency to forget that before we got to know a given fact in a theoretical way, there had been just a theory which let us to know it.

Such a theory was the ancient Greeks' theory of a spherical shape of the Earth in time when the flat Earth theory had ruled. Ancient Greeks proved the shape, using universally known three proofs. They are now taught in

elementary schools and the fact is indisputable – this is not a paradigm. In astronomy examples are: the Heliocentric System and the existence of the planet Neptune, theoretically predicted (no paradigms). In physics examples are: atmospheric pressure, the mutual gravitational attraction of all bodies, electricity, the atomic structure of matter, electromagnetic waves, the transformation of matter into energy (the existence of nuclear energy). In chemistry all elements, predicted by Mendeleyev's table. In biology: the existence of pathogenic bacteria, predicted and proved by Ludwig Pasteur, the double helix as a genetic code carrier. In geology (geophysics): the Earth as a magnet, glaciations, nappes, inversions of polarity of geomagnetic field, transform faults, spreading of the ocean floor. There are numerous examples of such theories and they constitute a core of the science and our practical life based on science.

The same kind of theory (but at the stage of theory) is now the expanding Earth theory, based on the earlier given seven proofs, which must be treated seriously.

The second kind of theories, though fundamental in science, are not attractive for philosophers who have a tendency to ignore them. Certainly Kuhn and Popper acted in this way. They both applied conclusions, developed on the basis of the first group of theories, to theories as such, causing an extreme mess in the cognitive approach to science. Within this mess it is possible to label the proofs of the expansion of the Earth as "models" or "informatics noise" (as mentioned earlier). Drowning in cognitive nihilism, we can equally well label the Greek's proofs of the spherical Earth in this way.

I have my own rich practical experience in the topic, as a person working on and discussing the expanding Earth over more than four decades. The experience also concerns the broad spectrum of the pathology in science which has resulted from the widespread cognitive relativism.

6. Return to classic scientific principle of testing theories

According to the Popper view, the demarcation line between science and non-science within the world of theories is, that scientific theory has to be only falsifiable, not verifiable. From this view a strange conclusion arises that the Ptolemaic theory was scientific but the Copernican theory not. Of course at the start the Heliocentric System was falsifiable but also **verifiable**. What is more, the latter procedure was conducted successfully and

the former procedure became pointless. The Heliocentric System (as a pure geometric and kinetic system) at the turn of 17th century ended its old life as a theory and began a new existence as a fact.

Thus we must return to the classical principle that scientific theory must be testable which means that it is falsifiable as well as verifiable. The principle is applicable to all theories of the second type. Many of them were falsified in the past but many were verified and serve us as indisputable facts marking a wonderful progress in science.

Expanding Earth is a theory of the second kind and as such it can be verified (proved as a fact), which I demonstrate in this paper and the others quoted.

Popper wrote in the introduction to his first English edition (1959) of "The Logic of Scientific Discovery" that from the very beginning the cognitive theory was inspired by the hope that it would not only allow us to understand the knowledge better but also would help us to push it forward.

It must be concluded that Popper's (and Kuhn's) contribution to cognitive relativism has blocked the progress in science and the result is that many opponents of Earth expansion locate themselves in the non-science side of demarcation line between science and non-science.

7. Expanding Earth as the end of the sequence of false geotectonic theories and as the solution of their mutual contradictions

Geotectonics is an extreme example of the sequence of false geoteconic theories. But this sequence does not lead to cognitive relativism but to the firm true geotectonic solution. The most important of the theories can be sorted in three groups:

a. theories of development of oceans

b. theories of development of continents

c. mobilism and fixism

The theories form, within each group, contradictory pairs and the solution of the contradictions between them is each time the expansion of the Earth.

Factual bases are wrongly explained. The expanding Earth rejects these wrong explanations and joins the bases in a coherent whole. It will be shown briefly below how this works for the first and the third group.

In the first group there is the land-bridge theory and the theory of the permanency of oceans. The first found, on the basis of paleontological and sedimentological data, that all oceans (together with the Pacific) are young, that is Meso-Cenozoic. The theory tried to explain this fact by the sinking of continental crust in the locations of today's oceans (false explanation). The theory of permanency of the oceans, based on the firm basis of isostasy which found that continental crust cannot sink in a much denser basement, concluded that the oceans have existed from the beginning of the Earth (false explanation). Wegener partly solved this contradiction by assuming a pulling apart of continental lithosphere instead its sinking. In this way he explained even better the basis of the land-bridge theory, avoiding its wrong interpretation. He also avoided the reservation from geophysicists side and their wrong explanation. However Wegener was inconsistent. He applied his revolutionary solution only to the Atlantic and the Indian Ocean. Its consequent application also to the Pacific means huge expansion of the Earth.

In the third groups is mobilism which found that continents move apart horizontally relative to each other and fixism which found that they stay in place relatively to their very deep basement. The only solution of this contradiction is the expanding Earth.

This was in a nutshell explanation of the problem. I devoted to it the whole lecture (see: www.wrocgeolab.pl/lectures.pdf, lecture 2). The topic is also mentioned in my other brochure www.wrocgeolab.pl/research.pdf, paragraph 9).

Thomas Kuhn wrote in the preface to *Copernican Revolution* (p. viii):

> *I am myself quite certain that the techniques developed by historians of ideas can produce a kind of understanding that science will receive in no other way.*

However Kuhnian historical approach led him to cognitive relativism. Quite the opposite, historical and logical analysis of the sequences of geotectonic theories leads us to a firm and unequivocal fact – the expansion of the Earth. The fact obtained in this way is also proved by several direct proofs as was pointed out earlier.

8. Plate tectonics as a paradigm, trying to shape geology like quantum mechanics

a. The story of the process

In the founding papers of plate tectonics the paradigm concept and the quantum mechanics style were not much present. But these were developing with time. Allan Cox made these connections, in a most spectacular way, in 1973. The author reprinted a collection of fundamental plate tectonic papers in his book, grouped them thematically and supplied each group with his own introduction. He presented very well the philosophy of the new discipline in his explanations.

Cox was a devoted adherent of Kuhn's cognitive concept. The first chapter of his book is fittingly entitled: "Paradigm of plate tectonics". Such an understanding of plate tectonics has become common in the following years.

In the chapter "Geometry of plate tectonics" Cox presented a well-elaborated axiomatic system of plate tectonics, quite in the style of quantum mechanics. It consists of **2 postulates, 3 definitions and 3 theorems**.

But the system omits the most important postulate of plate tectonics – that the Earth is not expanding, leaving it as a tacit (secret) assumption. That is why I call it an **incomplete axiomatic system**. The system is quoted below (Cox, 1973, p. 40-42).

b. Incomplete, officially presented axiomatic system of plate tectonics

▪ ***Definition 1, plates***.

The lithosphere, defined as the rigid outer shell of the earth (roughly 100 km thick), is divided by a network of boundaries into separate blocks which are termed "plates."

▪ ***Definition 2, boundaries***.

Boundaries are lines separating plates. Boundaries are of three types.

a. Ridges, where two plates are diverging, permitting the upwelling of magma that creates new lithosphere. (The direction of relative motion of the two plates does not need to be perpendicular to the ridge.)

b. Trenches **or** ***sinks***, where two plates are converging, with one plate moving beneath the other eventually to be absorbed into the mantle, or "de-

stroyed." (The direction of relative motion of the two plates does not need to be perpendicular to the trench.).

c. Transform faults, where two plates are moving tangentially to each other. Lithosphere is neither created nor destroyed. The direction of relative motion of the two plates is exactly parallel to the fault.

Postulate 2. The plates are internally rigid but are uncoupled from each other. At their boundaries two plates may pull apart or slip one beneath the other, but within the plates there is no deformation.

▪ ***Definition 3, pole of relative motion***.

The pole of relative motion between two plates is the unique point on the globe that does not move relative to either of the two plates. (Strictly speaking, each pole has an antipodal point on the opposite side of the globe.). The pole may be visualized as a pivot point about which the two plates rotate relative to each other.

Postulate 2. The pole of relative motion between a pair of plates remains fixed relative to the two plates for long periods of time.

The following theorems follow from Postulate 2.

Theorem 1. Transform faults between two plates lie along segments of concentric small circles centered on the pole of relative motion of the two plates.

Theorem 2. The pole of relative motion for two plates may be found by constructing perpendiculars to local segments of transform faults. The common intersection of the perpendiculars is the pole.

Theorem 3. The width W of new lithosphere formed adjacent to a given interval of time decreases from a maximum width W_0 at an arc distance A = 90° from the pole of relative motion to zero width at the pole itself. Quantitatively, $W = W_0 \sin A$ where A is the arc distance from the pole to the point of observation and W is the width of new lithosphere measured parallel to the direction of relative motion between the two plates.

If we add the missing assumption (postulate), the system becomes full and real.

c. Full and real axiomatic system of plate tectonics[5]

This system comprises 3 postulates, 3 definitions and 3 theorems (3x3). It is presented below. My supplements are in **bold red**.

[5] Formulated and commented by me (J. K.).

Postulate 1. **The Earth is not expanding (basic, false and tacit postulate of plate tectonics).**

▪ ***Definition 1, plates***.

The lithosphere, defined as the rigid outer shell of the earth (roughly 100 km thick), is divided by a network of boundaries into separate blocks which are termed "plates."

▪ ***Definition 2, boundaries***.

Boundaries are lines separating the plates. Boundaries are of three types.

a. Ridges, where two plates are diverging, permitting the upwelling of magma that creates new lithosphere. (The direction of relative motion of the two plates does not need to be perpendicular to the ridge.).

The following *Definition 2b* results from the *Postulate 1* and does not agree with reality.

b. Trenches **or** ***sinks***, where two plates are converging, with one plate moving beneath the other eventually to be absorbed into the mantle, or "destroyed". (The direction of relative motion of the two plates does not need to be perpendicular to the trench.).

c. Transform faults, where two plates are moving tangential to each other. Lithosphere is neither created nor destroyed. The direction of relative motion of the two plates is exactly parallel to the fault.

The phrase in the following Postulate 2 "*slip one beneath the other*" results from *Postulate 1* and does not agree with reality.

Postulate 2. The plates are internally rigid but are uncoupled from each other. At their boundaries two plates may pull apart or slip one beneath the other, but within the plates there is no deformation.

The whole final section results from the *Postulate 1* and does not agree with reality.

▪ ***Definition 3, pole of relative motion.***

The pole of relative motion between two plates is the unique point on the globe that does not move relative to either of the two plates. (Strictly speaking, each pole has an antipodal point on the opposite side of the globe.) The pole may be visualized as a pivot point about which the two plates rotate relative to each other.

Postulate 3. The pole of relative motion between a pair of plates remains fixed relative to the two plates for long periods of time.

Theorem 1. Transform faults between two plates lie along segments of concentric small circles centered on the pole of relative motion of the two plates.

Theorem 2. The pole of relative motion for two plates may be found by constructing perpendiculars to local segments of transform faults. The common intersection of the perpendiculars is the pole.

Theorem 3. The width W of new lithosphère lithosphere formed adjacent to a given interval of time decreases from a maximum width W_0 at an arc distance $A = 90°$ from the pole of relative motion to zero width at the pole itself. Quantitatively, $W = W_0 \sin A$ where A is the arc distance from the pole to the point of observation and W is the width of new lithosphere measured parallel to the direction of relative motion between the two plates.

That above is the essence of plate tectonics false paradigm.

d. Reduction of plate tectonics to the non-expanding-Earth hypothesis

Disclosing the main postulate of plate tectonics allows us to reduce it from the rather complicated form of paradigm to simply **non-expanding-Earth theory,** which is a theory of the mentioned second type i.e. it can be true or false in absolute sense. The theory is in a simple contradictory relation with the expanding Earth as its negation. Thus every proof of the second is falsification of the first.

9. Circular arguments – a methodological bungle of plate tectonics

a. Principle of circular argument

A circular argument is a mistaken way of reasoning and has a simple structure (Fig. 3).

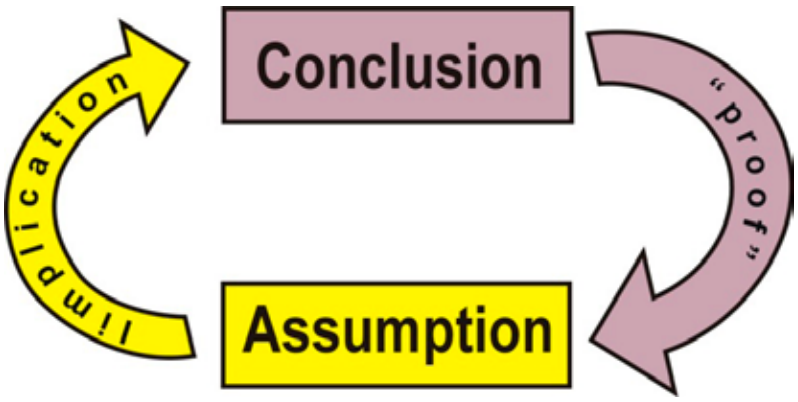


Fig. 3. *The principle of circular argument*

b. Principle of multi-storey circular argument

A multi-storey circular argument occurs when on the first conclusion the second conclusion is built which is to prove the first (Fig. 4).

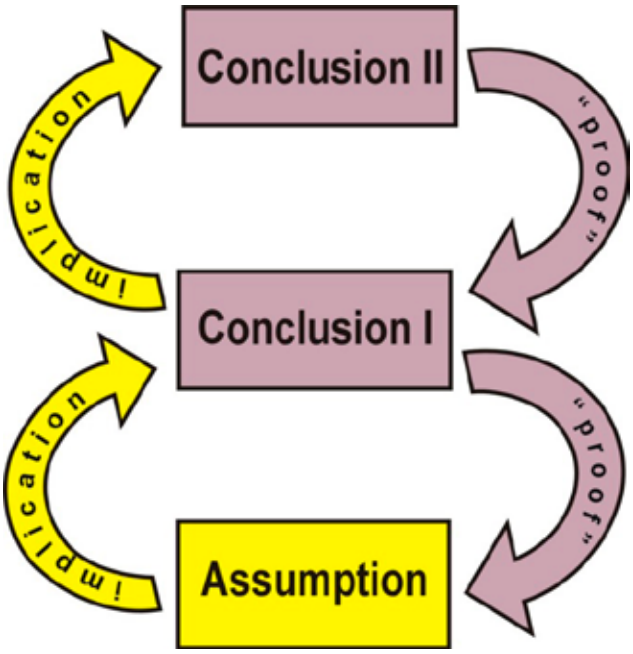


Fig. 4. *The principle of multi-storey circular argument*

Plate tectonics consists of several multi-storey circular arguments which will be demonstrated in chapter III.

The top floor of a multi-storey circular argument is treated in such a structure as also a proof of the basic assumption (Fig. 5). In plate tectonics this is the non-expanding-Earth assumption.

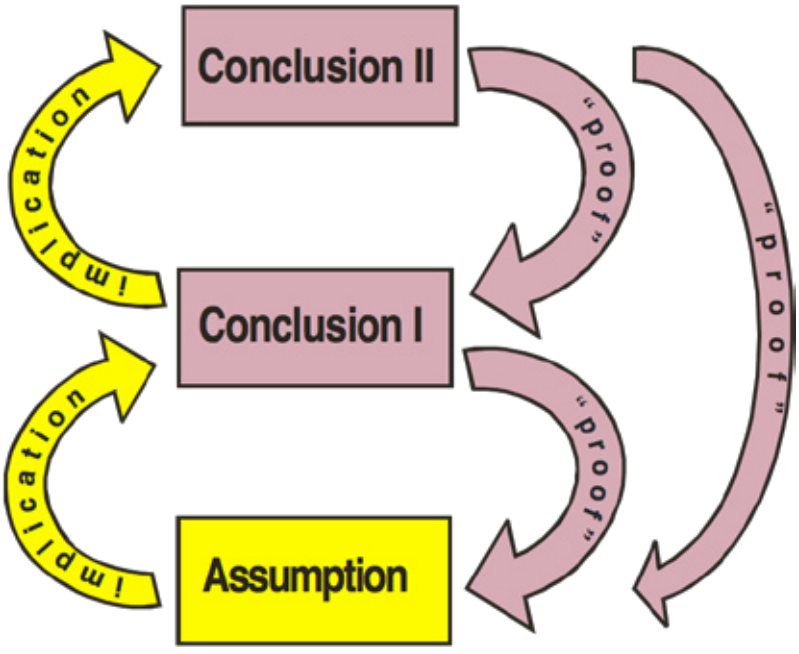


Fig. 5. *"Proof" of the basic assumption by the top floor of the multi-storey circular argument*

c. Plate tectonics as a system of multiple circular arguments

As was mentioned in paragraph I.2, plate tectonics constructed several false models on the basis of its false fundamental non-expanding-Earth assumption which were then equated with reality and treated as proofs of the assumption. Its multiple circular structure is presented by Fig. 6. It also consists of some storey circular arguments.

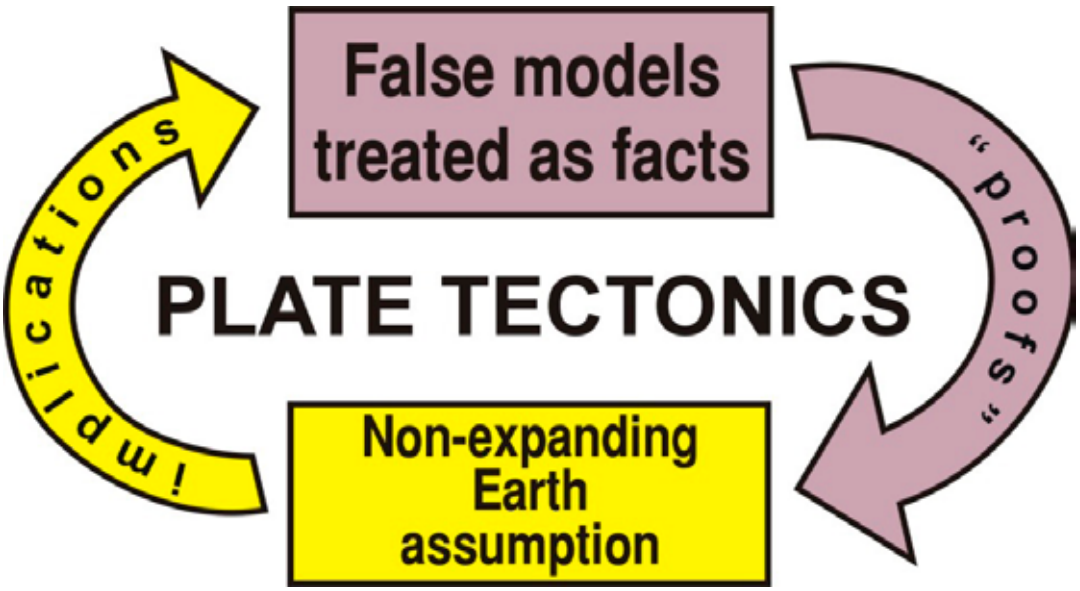


Fig. 6. *Plate tectonics multiple circular arguments based on non-expanding-Earth assumption*

Otherwise the concept of a paradigm rejects the institution of "proof". In fact however plate tectonicists have treated their circular arguments as "proofs". Thus I follow this custom putting only the term "proof" in inverted commas. Only the proofs of the expanding Earth are treated by them consequently according to principles of cognitive relativism, i.e. they are ignored. This is a great logical inconsistency of plate tectonics.

Because the false models of plate tectonics are derived from the same false assumption, they are mutually coherent and this became the main argument in favor of plate tectonics. In this way this false theory has attained remarkable longevity.

The specific circular arguments of plate tectonics, twelve in number, will be demonstrated in the next chapter.

III. Plate tectonics in a space of circular arguments

In 1974 McKenzie and Parker published a paper entitled "*Plate tectonics in ω space"*. The *ω* (omega) space is of course the space of Euler vectors deduced from the non-expanding–Earth assumption. The paper is a good example of making almost theoretical physics from geology. In fact however, plate tectonics found itself in the space of circular arguments.

Below we enumerate these circular arguments. Some of them were discussed in the former paper. The topic was also discussed in www.wrocgeolab.pl/Carpathians.pdf p. 45 under a title: *Plate tectonics – a theory on the wheels of circular arguments*.

The first two circular arguments use Euler's theorem, which is a false model for the Earth, deduced from the false non expanding-Earth assumption.

1. Space geodesy "proof" of the non-expanding-Earth

The problem is demonstrated in chapter 14 of the Part One of this book: *An attempt of rejection the expanding Earth using Eulerian calculations – a circular argument* (p. 51).

2. Alleged balance of the Earth's surface area as a "proof" of the non-expanding Earth and thus the converging plates

In the "omega space" all increments and decrements of the lithosphere must be balanced according to Euler's theorem. Thus divergent motions of plates must be compensated by their convergent movement. This balance follows on the deeper level from the non-expanding-Earth assumption. Thus, pointing to this balance as a proof of the non-expanding-Earth hypothesis (see Dziewoński, 1999) is a circular argument (see page 164 of the main text of the paper).

3. Relative shrinking of plates on the expanding basement or how expanding Earth helps plate tectonics to make circular arguments

When the expansion of Earth takes place but is not being taken into account (neglected) then all plates seem to be relatively and apparently shrinking. The relation is explained in my paper (Koziar, 2011) *Expanding Earth*

and Space Geodesy (extended abstract) www.wrocgeolab.pl/geodesy1.pdf, in two chapters (4) *Blinov's principle* and (5) *Blinov's principle demonstrated on a plate lying on an expanding basement with an expanding geodetic graticule* . The fictitious process is recorded by space geodesy and interpreted as converging motion of plates. This apparent converging movement confirms non-expanding-Earth assumption on the basis of a circular argument.

4. Subduction model of island arcs and active continental margins as a "proof" of the non-expanding-Earth

In September 1968 Bryan Isacks, Jack Oliver and Lynn R. Sykes published what is perhaps the most important paper for plate tectonics: *Seismology and the New Global Tectonics*. In this paper the model of subduction was presented in compatibility with the "new global tectonics" – that is with plate tectonics. Within a few years subduction became the most famous process of plate tectonics. Laymen often do not even know about spreading and oceanic ridges but about subduction they do. Subduction came to be treated as a fact and as such as a "proof" of converging plates, as the most important specific feature of the plate tectonics. However such proof has also the character of a circular argument. Let us remind ourselves of Le Pichon's way of thinking:

> *If the earth is not expanding, there should be other boundaries of crustal blocks along which surface crust is shortened or destroyed.*

The three authors wrote on page 5866:

> *If crustal material is to descend into the mantle, the island arcs are suspect as sites of the sinks.*

The descending material in the sense of plate tectonics is a fact for them. The only problem was to build a proper model and this was done by the authors. The model implies that the whole Pacific plate moves against East Asia and Australasia. However it quickly turned out that all island arcs of the west Pacific migrate in opposite direction (see figures below).

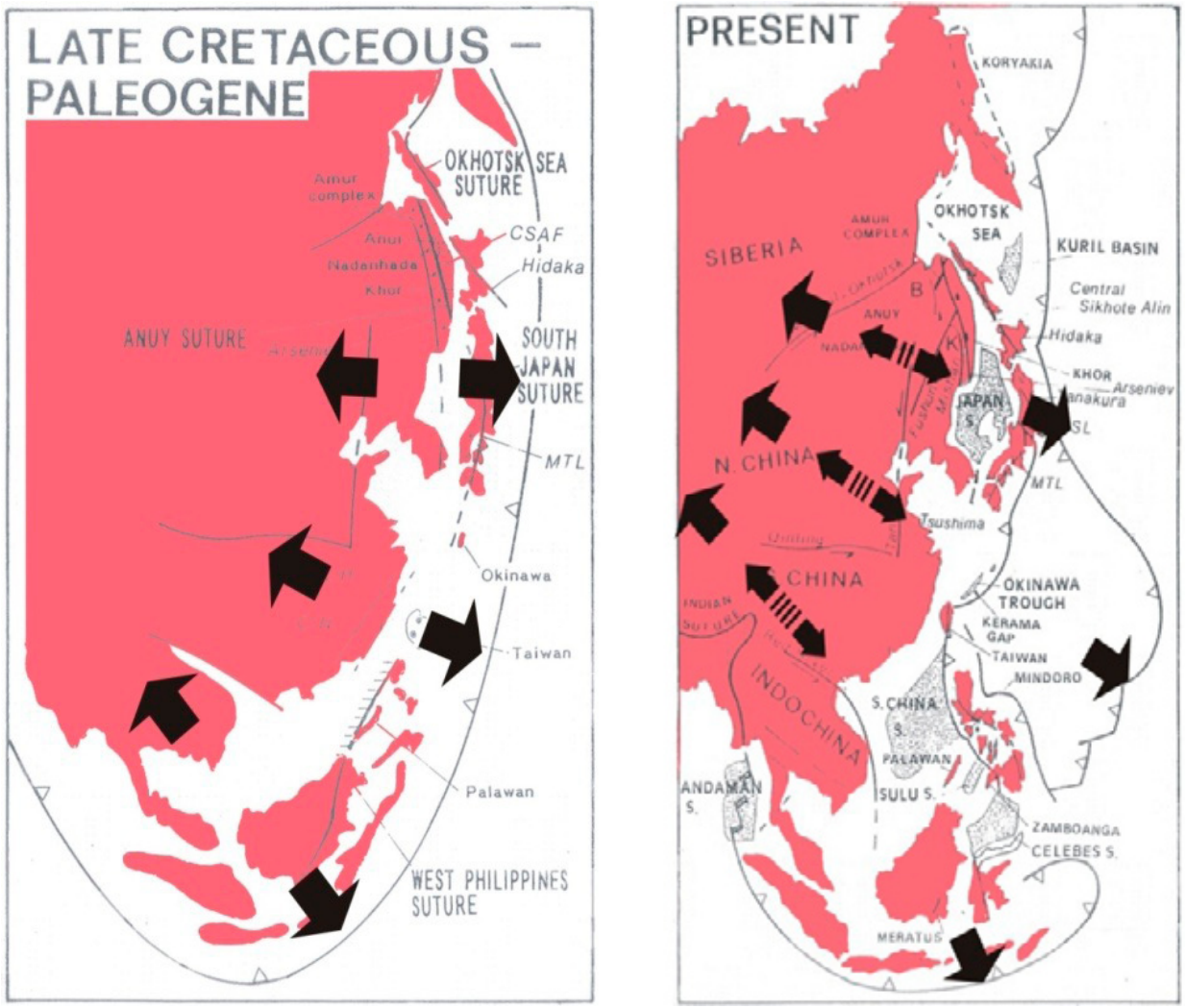


Fig. 7. *Tearing away of the Pacific plate from Asia continent (on the basis of figure by Faure and Natalin – 1992, arrows JK)*

The figures are made by plate tectonicists Faure and Natalin (1992), the arrows are put by me. The process was recognized much earlier by D.E. Karig already in 1971. The fact did not shake plate tectonics, no alarm bells rang, and the paradigm rushed ahead unperturbed. The situation is a good example of the often unhealthy superior treatment of an a priori assumption over facts visible to the naked eye.

Other facts were no less striking. Among these are: a tensional regime in oceanic trenches as recorded by seismic analysis, normal fault deformation of oceanic plates beneath them and beneath the frontal part of island arcs, and much lower thickness of the Wadati – Benioff zone than thickness of oceanic plate. All these determine the mechanism of deformation as in Fig. 8b. However Isacks et al. (1968) chose the mechanism as in Fig. 8a, which is determined by an a priori non-expanding-Earth assumption.

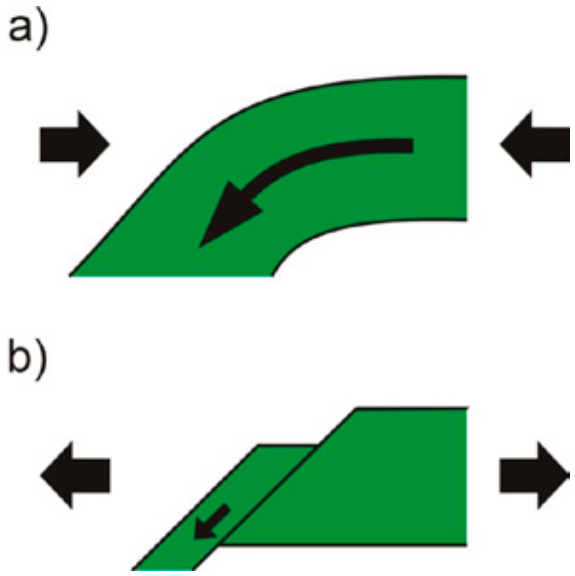


Fig. 8. *Juxtaposition of two types of deformation of oceanic plate at oceanic trenches,*
a) *determined by an a priori non-expanding-Earth assumption,*
b) *determined by facts*

Another astonishing interpretation was made by the above authors in regard to mechanism of "tsunami" earthquakes beneath frontal parts of islands arcs and active continental margins. They are as in Fig. 9a. The sinking of lithosphere at oceanic trenches and its upwelling at vicinity of volcanic lines determine a gravitational transport of the whole island arc ocean-ward and its overthrust on oceanic lithosphere (Fig. 9c). However the authors arbitrarily chose underthrusting of oceanic lithosphere under an island arc according to the a priori non-expanding-Earth assumption and subduction implicated by the latter.

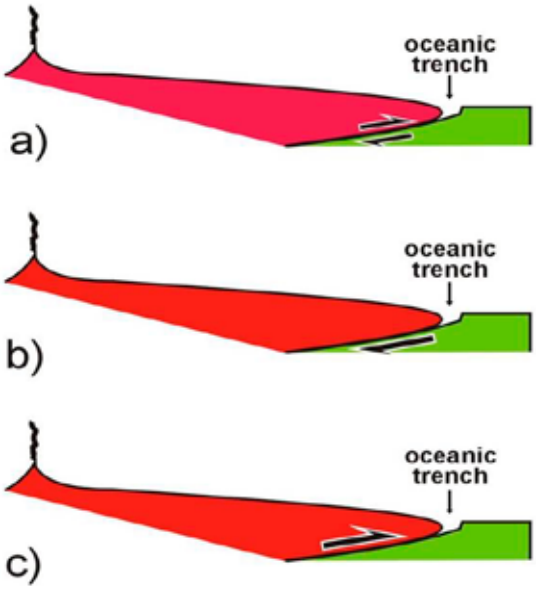


Fig. 9. *Mechanical relations of island arc relative to oceanic plate (explanation in text)*

The mentioned geological facts are not the only ones but are the most important for building a sketchy but proper scheme of the whole mechanism working at island arcs and active continental margins (Fig. 10; Koziar, 2003; www.wrocgeolab.pl/margins2.pdf and www.wrocgeolab.pl/margins2a.pdf.

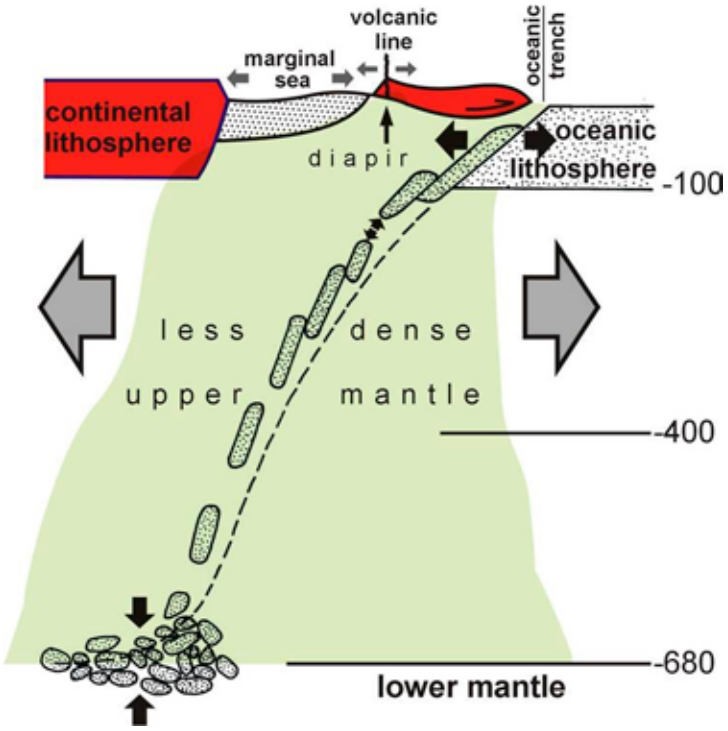
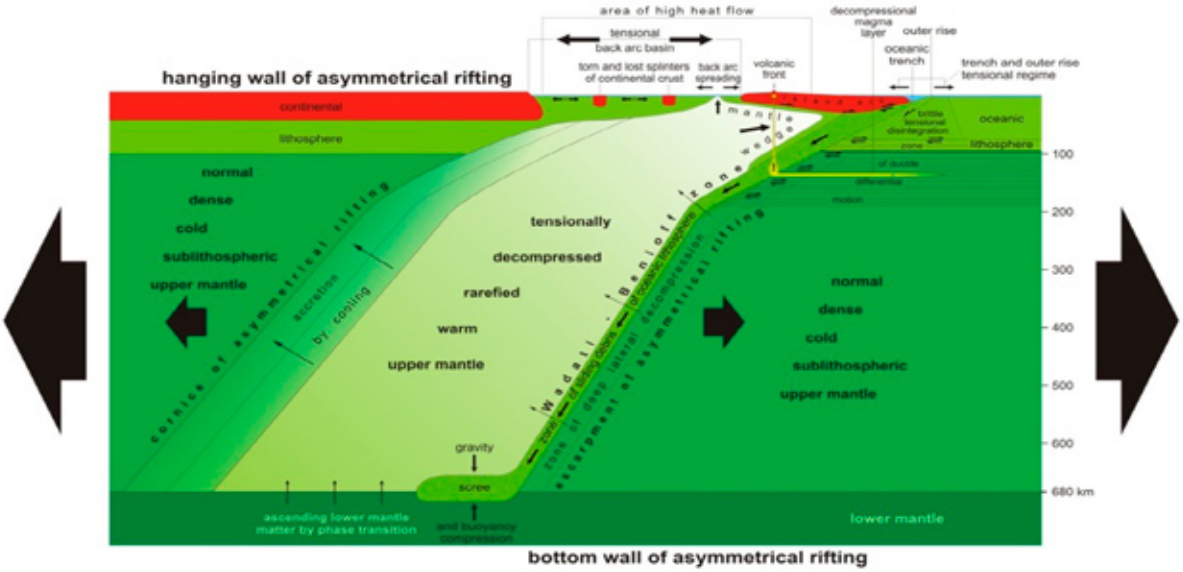


Fig. 10. *Sketchy scheme of tectonic mechanism working at island arcs and continental margins (Koziar, 2003)*

Recently I elaborated a more detailed version (see figures below). The version was presented on the XIX Meeting of the Society of Geologists Alumni of Wrocław University held on 28 January 2017 at Wrocław University and will be the subject of a subsequent brochure. Here there is no space for a detailed explanation.



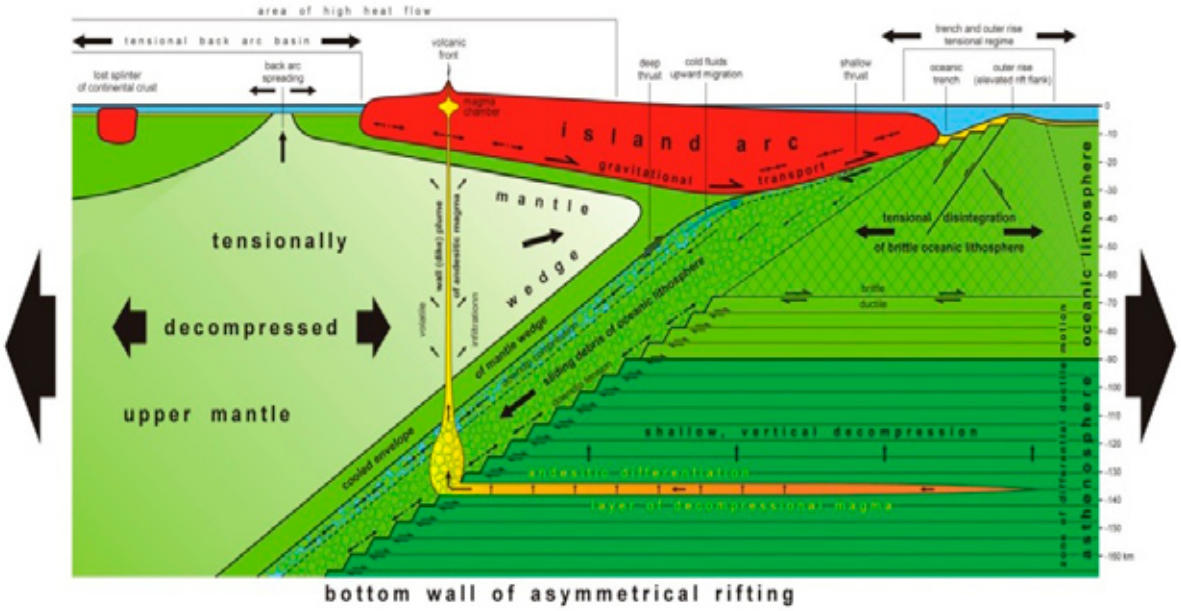


Fig. 11. *Tension-diapiric-gravitational development of island arcs. The detailed mechanism*

5. Subduction model of seismic conductivity of the Wadati-Benioff zone as a "proof" of subduction

Isacks et al. (1968) recorded a high seismic conductivity of the Wadati-Benioff zone against extremely low conductivity below marginal sea (above the zone) and low conductivity in ocean direction (beneath the zone) – Fig. 12.

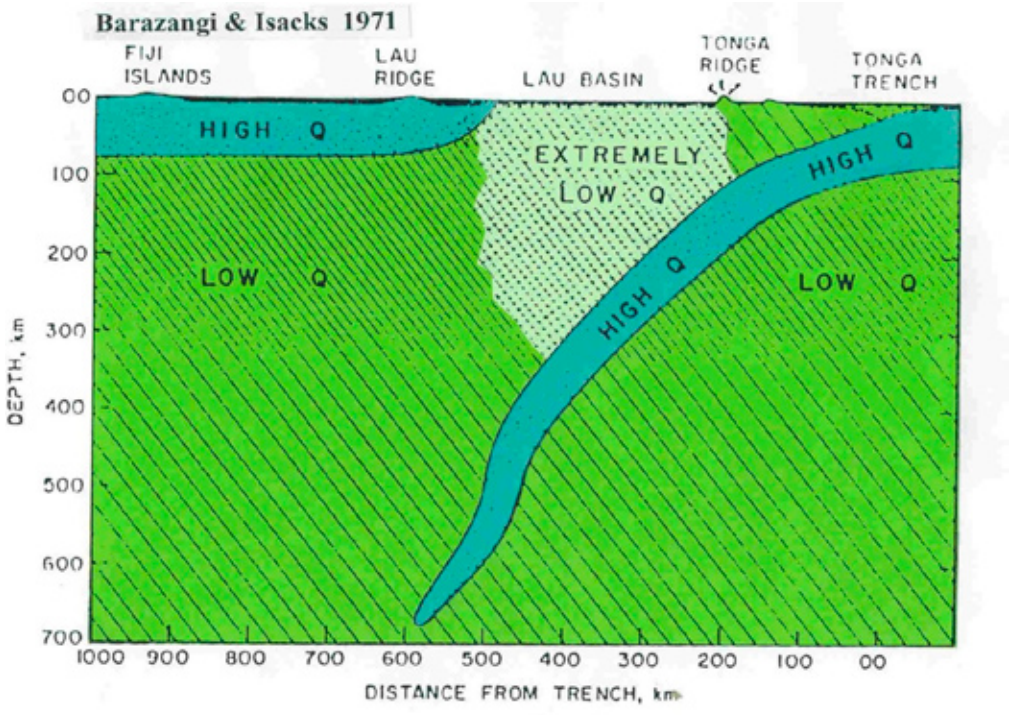


Fig. 12. *High seismic conductivity of the Wadati-Benioff zone against its surrounding, interpreted according subduction concept (Barazangi & Isacks, 1971)*

This convinced them correctly that the cold and brittle oceanic lithosphere is present inside the zone. However they interpreted the fact one-sidedly based on subduction model (Fig. 8a) which in turn is based on the non-expanding-Earth assumption. Thus the subduction model of high seismic conductivity of the Wadati-Banioff zone is a circular argument relative to subduction and a multi-storey circular argument in relation to non-expanding-Earth assumption.

It is clear that the tensional (divergent) mechanism of island arc (Fig. 8b) also explains the presence of lithosphere material in the Wadati-Benioff zone and thus the high seismic conductivity of the latter. Even if sinking lithospheric material is not continuous its movement produces laminar structure inside the zone. The structure is parallel to the zone itself causing its good acoustic conductivity.

6. Subduction model of contamination of andesitic magma by oceanic lithosphere material as a ”proof” of subduction

Andesitic magma in island arcs and active continental margins is contaminated by oceanic lithosphere material. This is treated by plate tectonicists, especially in petrology discipline, as a proof of subduction. But it seems as a proof only if one assumes that the subduction model of the presence of oceanic material in the Wadati-Bernioff zone is true. In fact the reasoning has a circular structure. Relative to the non-expanding-Earth assumption it is a multi-storey circular argument as in the previous case.

7. Subduction model of UHP metamorphism as a “proof” of subduction

Since about three decades continental rocks with UHP metamorphism have being found and interpreted as a product of a very deep subduction to even 200 km. It is supposed that subsequently they are returned to the Earth surface (exhumed) by significant buoyancy of continental crust. The process is even labeled *“go to hell, and come back to heaven*” (Yang et al. 2011).

It is worth to mention that at the beginning of the concept of subduction the continental lithosphere was excluded from the concept simply because of its high buoyancy. Today, the assumed continental subduction becomes one of the main “proofs” of subduction as such. In some regions the total volume of continental lithosphere, supposed to have been pushed to extreme

depths and then recovered, is gigantic. A prime example is the long 4 thousand km zone from the Kazakh block (Kokchetav Masiff) up to east China (Sulu UHP Terrane) along which UHP metamorphosed rocks are found. The zone is called Central Asian Orogenic Belt (CAOB). The volume of supposedly exhumed continental material there, is approximately 1.6 x10^6 km^3 (Dobrzhinetskaya and Faryad, 2011).

However plate tectonicists themselves admit that their paradigm is unable to explain the origin of intracontinental fold belts. Except that, alleged subduction of continental lithosphere rules out the last resort for plate tectonics driving mechanism, that is the hybrid *ridge-push-slab-pull* concept.

The fundament of petrologists' faith in UHP subduction is opinion that UHP conditions are impossible at shallow parts of lithosphere. However they are possible. Of course significant overpressure is impossible on regional scale because in this case the whole region would be uplifted. However on a local scale rocks are resistant to overpressure and the shallower the better.

It can be calculated that in a normal, undeformed granite body an UHP overpressure of 5 GPa (150 km of lithostatic pressure) can be achieved at a depth of 22 m in a cavern of 2 m in diameter. The same overpressure can be achieved at a depth of 5 km in a cavern (hydraulic trap) of circa half kilometer in diameter (Koziar, 2017).

The overpressure may be of hydraulic or mechanical origin. The first can be illustrated by the model of an inverted Pascal barrel (Fig. 13; Koziar, 2009). The second by anvils model at transpression sections of faults (Fig. 14; Koziar, 2017).

Local generation of overpressure well explains isolated occurrences of small UHPM bodies surrounded by rocks of lower grade of metamorphism. In the subduction UHP model such situation is quite incomprehensible.

The mechanical overpressure explains also well the lenticular form of UHPM bodies (see above figure) and their frequent occurrence in tectonic mélange. Both mechanisms explain well the rapid decompression which is shallow and in situ. Plate tectonics interpretation is strange rapid transport from extreme depth to the Earth surface.

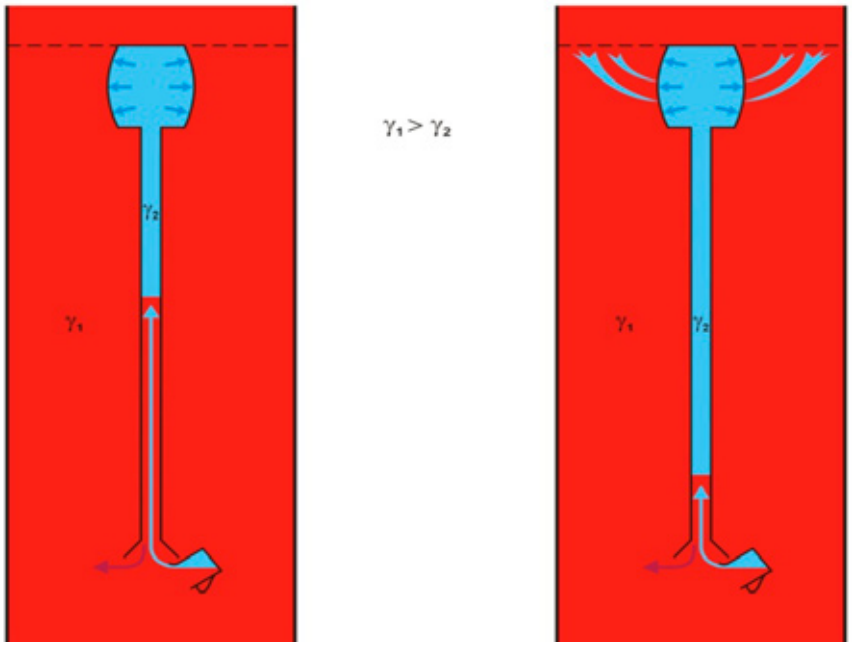


Fig. 13. *Inverted Pascal barrel demonstrating origin of hydraulic overpressure in lithosphere (Koziar, 2009)*

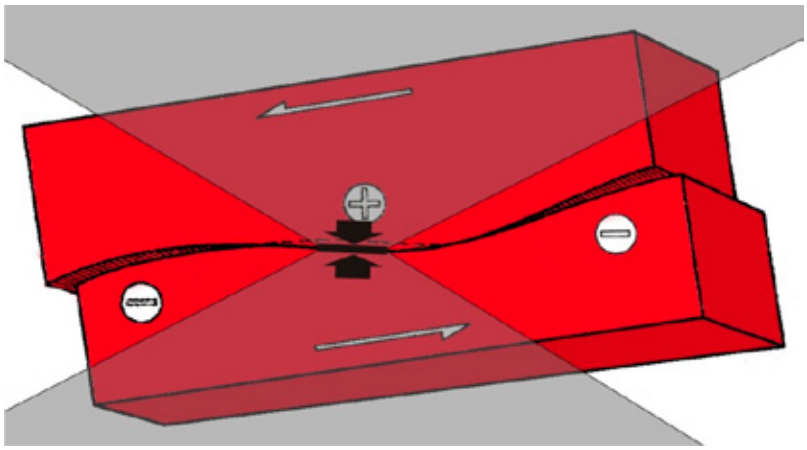


Fig. 14. *Anvil-press mechanism generating mechanical overpressure at transpression sections of fault (Koziar, 2017)*

The mechanical overpressure applies well to the mentioned Asian UHP zone, because it lies within sustained zone of general dextral transtension between Angara Block in the North and India Block together with South China Block in the South. Within such a zone several local transpressions could occur.

The subduction model of UHPM can be only treated as a proof of subduction if one believes that only subduction can explain this metamorphism. But it is not true. Thus in fact it is the "proof" of circular argument principle. Once again, it is a multi-storey circular argument.

8. Subduction model of fold belts as a "proof" of alleged closing and closed oceans

In 1970 John F. Dewey and John M. Bird published one more fundamental for plate tectonics paper entitled *Mountain Belts and the New Global Tectonics*. In the first sentence of the abstract a clear circular argument is presented supporting plate tectonics (p. 2625):

> *Analysis of the sedimentary, volcanic, structural and metamorphic chronology in mountain belts,* ***and consideration of the implication of the new global tectonics (plate tectonics), strongly indicate that mountain belts are a consequence of plate evolution*** (bold JK)**.**

This sentence is a wonderful example of circular argument, which is superimposed on the concept of subduction creating a multi-storey circular argument built on the non-expanding-Earth assumption.

In fact fold belts are tensional-diapiric-gravitational origin as was correctly recognized by S.W. Carey (see www.wrocgeolab.pl/Carpathians.pdf). The tensional mechanism of fold belts is not deduced from an assumption of the expansion. Thus it proves the expansion in the proper way (avoiding a circular argument).

9. Subduction model of ophiolites sutures as a "proof" of the alleged closed oceans

Ophiolites as specific series of rocks were recognized by Steinmann (1905), long before plate tectonics appeared. They were interpreted as eugeosynclinal series and eugeosynclinals themselves as long, deep and **narrow** basins, not oceans.

The eugeosynclinal itself, together with the whole geosynclinals system turned out to be of tensional origin in spite of early speculative interpretations done on the basis of the theory of contraction of the Earth and the collisional aspect of Wegener's theory (Argand, 1916). The change happened in 1940s and 1950s, starting with Güntzler-Seifert's paper (1941) and finished by Trümphy's one (1958). Argand's compressional cordilleras turned out to be horsts separated by grabens which together determine a tensional regime. As such, the eugeosynclinal is a deep rift reaching down to a simatic basement. They can be initial oceans or parts of frozen tensional-diapiric-gravitational fold belts which proves the expansion of the Earth (see preceding paragraph).

In plate tectonics, the ophiolites are built in the Dewey and Bird scheme and became a "proof" of the "closed oceans" but only on the principle of circular argument as a top element of an extreme multi-storey circular argument (Fig. 15).

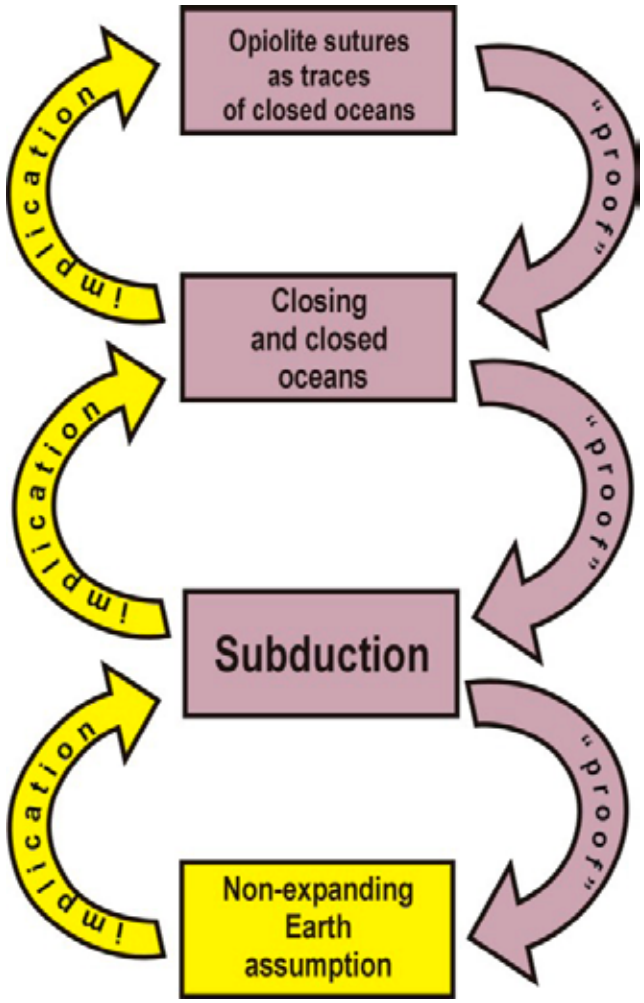


Fig. 15. *Ophiolite sutures as traces of closed oceans on the top floor of a multi-storey circular argument*

As such they became a favorite argument of petrologists against the expanding Earth.

The tension-diapiric-gravitational origin of ophiolites sutures are explained in www.wrocgeolab.pl/Carpathians.pdf, in paragraphs:

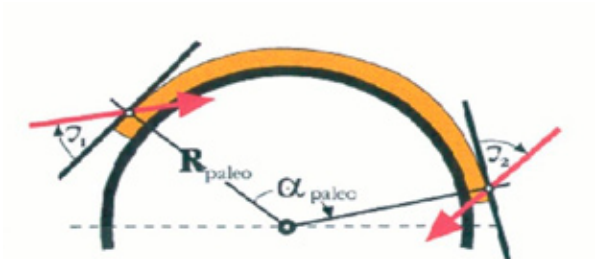
1. *Scheme of the development of a fold belt based on the example of the Carpathians Mts,*

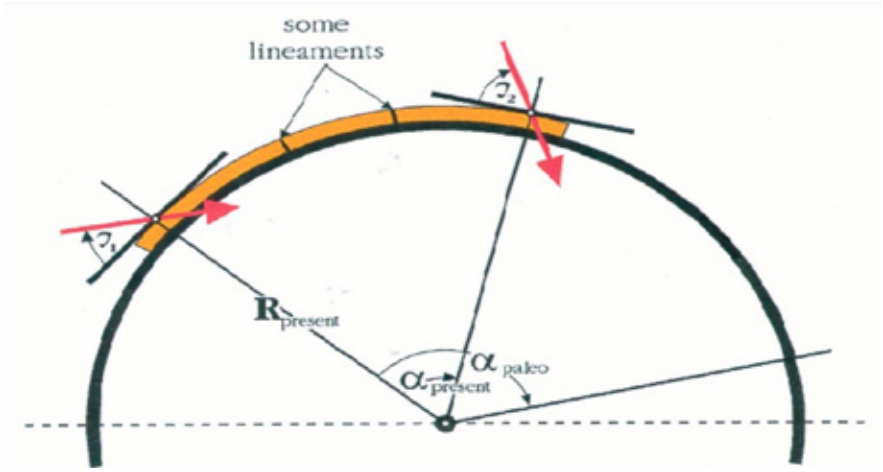
3. *Scheme of tension – diapir – gravitational development of an ophiolite suture (with analogy to the Carpathian Pieniny Klippen Zone)*

4. *Tension – diapir – gravitational development of an ophiolite suture, shown on the Zagros Mts. example (pages 36-40).*

10. Paleomagnetic „proofs" of the alleged closed oceans

Paleomagnetism had played a negative role, undermining the expansion of the Earth as was shown in the Part One, I. 5. Then it was used to prove the alleged process of the closing of oceans. However this supposed proof is based on circular argument. I had pointed that out in my paper (Koziar, 2006). However it is not yet translated into English so I extract a relevant part in what follows. In Fig. 16 a the smaller Earth is presented with a rigid plate which is only slightly stretched during expansion. At the edges of the plate two magnetic vectors of the contemporary magnetic field are recorded in the rocks.





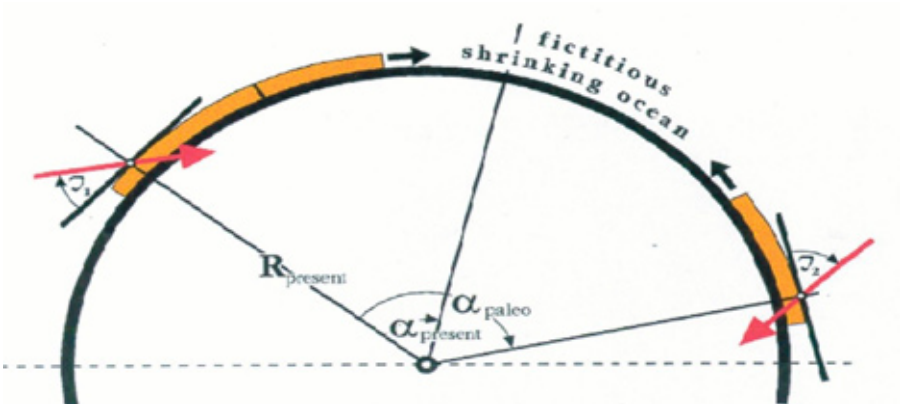


Fig. 16. *Incorrect paleographic reconstruction resulting from incorrect paleomagnetic method (explanation in text)*

The inclinations of these vectors determine contemporary central angle (α_{paleo}) of the two sites. After expansion of the Earth up to today's size (Fig. 16 b) the real central angle is reduced (α_{recent}) but the recorded angle not, and now a much bigger distance on the Earth's surface corresponds with it. The plate tectonicists, not seeing expansion, conclude that the two sites (vectors) had to converge. Then they look for some lineament which can be interpreted as a suture representing the closed ocean (again Fig. 16b). Then they disrupt the plate and create this fictitious ocean (again Fig. 16c). Then they insist that the ocean has been closed, what was allegedly precisely proved. However the "proof" is based on an a priori assumption not on a real fact. Then, if they insist that the closed oceans are "proofs" of the non-expanding Earth, the circularity is complete.

11. Terranes as an extreme multi-storey circular argument "proving" plate tectonics

Alleged closing oceans are one of the plate tectonics phantoms introduced to geology within its main circular argument. However on this phantom another circular argument was built and other phantoms appeared (the second generation of phantoms). These are so called terranes. They are treated by plate tectonicists as facts and are the most ubiquitous "proofs" of their paradigm because all continents are to be so called "amalgamation" of terranes.

In my paper *"Terranes or geology in Wonderland*" (Koziar, 2006), which is not yet translated to English, I explained how this concept was built and then I reinterpreted two big areas of apparent terranes to a very simple geology. These areas are: Pacific rim and Tethys zone. Both areas are victims of the concept of closing oceans. The Pacific is to be a closing ocean, the Tethys zone is to be a trace after a closed ocean.

Beneath, I demonstrate how this bizarre concept of terranes was build on the examples of the Southern Atlantic and Pacific oceans. The first is my *ad absurdum* example. The second is an analogical example created and treated seriously by plate tectonicists.

As we now correctly know, the Southern Atlantic came into being by moving apart of Africa and South America (Fig. 17a)

a

b

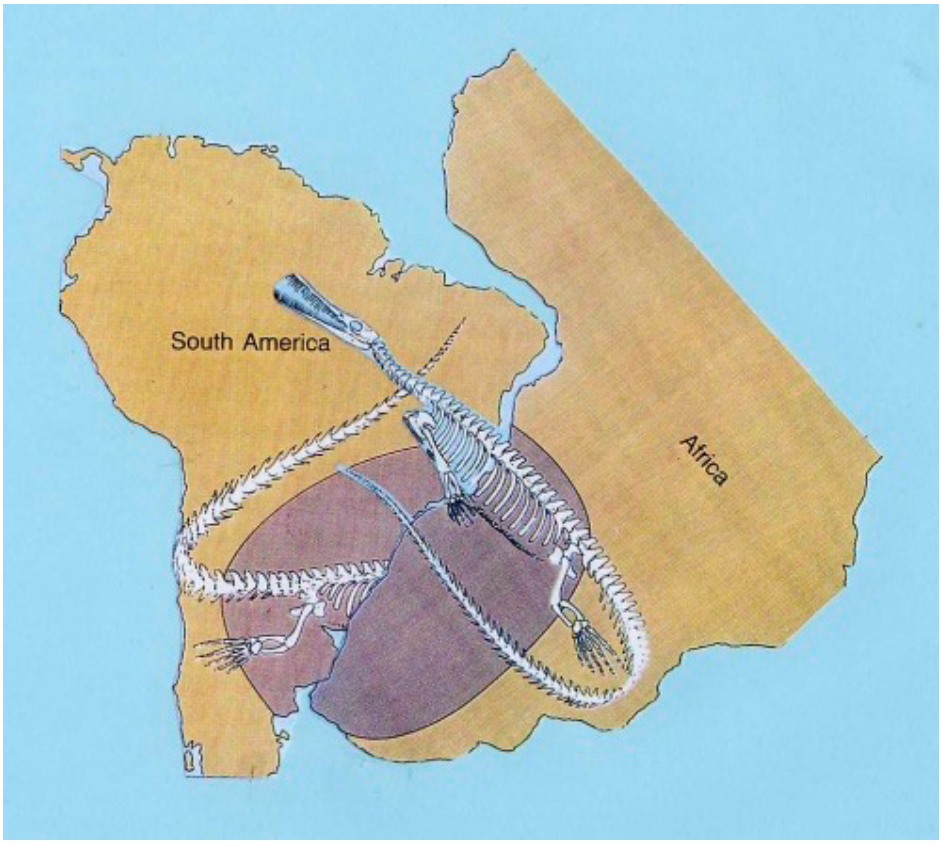


Fig. 17. *On the basis of figure by Tarbuck and Lutgens (1988). Explanation in text*

Two (now separated) regions of occurrence of Triasic land reptile Mesosaurus point out (among others) such an interpretation. So we reconstruct the region correctly as in Fig. 17b.

However let us suppose that on the basis of an a priori assumption we are firmly convinced that the South Atlantic is a closing ocean (Fig. 18a).

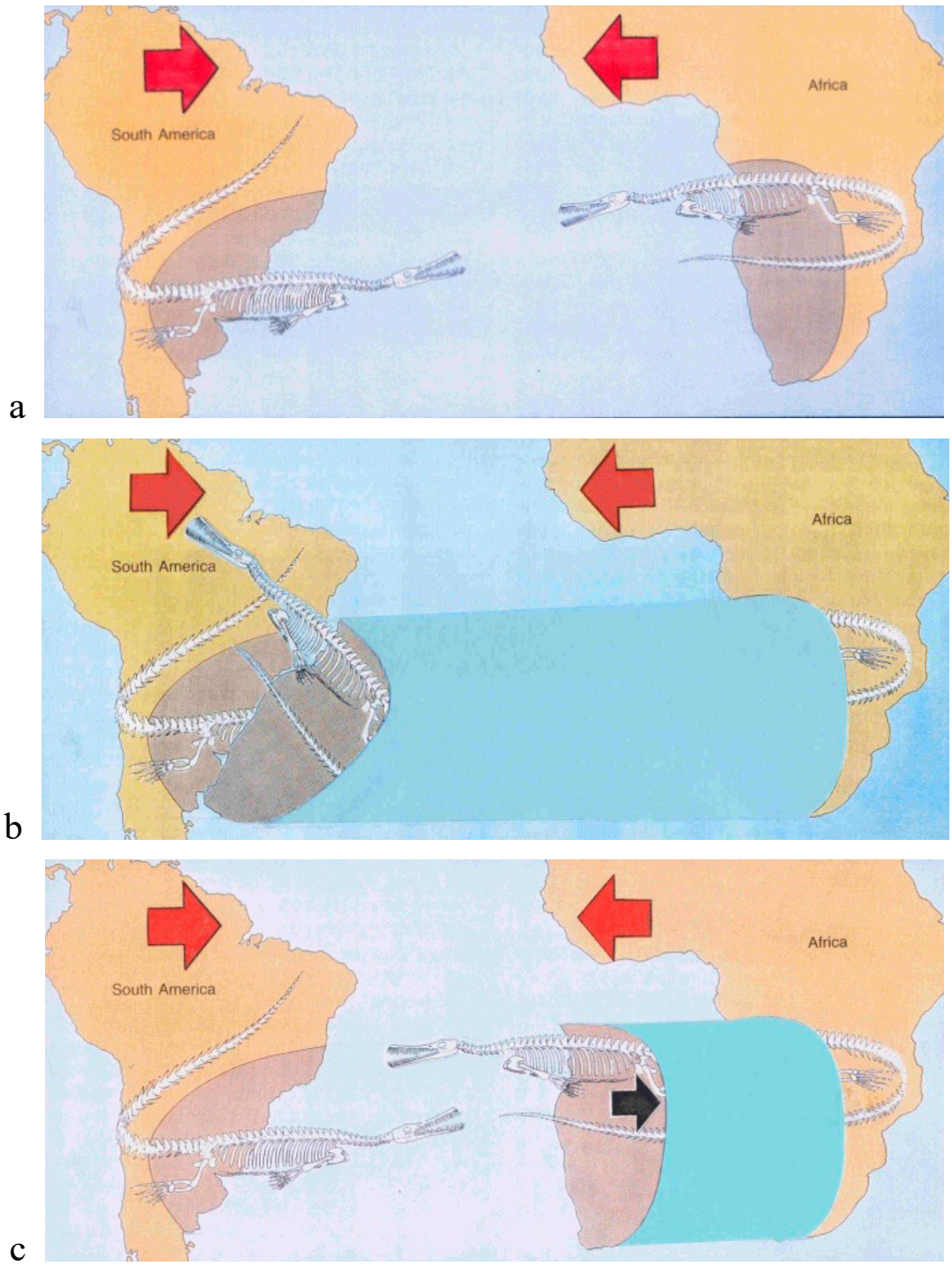


Fig. 18. *On the basis of figure by Tarbuck and Lutgens (1988). Explanation in text*

Thus we are compelled to do some very strange interpretation. Namely, we must assume that now separate areas of occurrence of the reptiles were earlier together on one side of the closing Atlantic – for instance on South American side (Fig. 18b). Then we must assume that the today African part was transported to Africa through the "closing" Atlantic (Fig. 18c) in order to obtain its present position after "docking" (terrane concept term) in Africa (Fig. 18a).

The piece of land inside of "closing" Atlantic (Fig. 18c) is just a **terrane**.

The above interpretation is an obvious nonsense. However it is treated quite seriously in the Pacific Ocean. This ocean was, in time of land bridge theory, treated exactly as other oceans. It was young and of progressive development. Numerous land connections around it point this out. The young age of the Pacific basin was rejected on the basis of non-expanding-Earth hypothesis first in Wegener's theory, then in plate tectonics paradigm. So was rejected its progressive development. However the cross-Pacific connections stayed. For instance the whole North and Central American Cordilleras have an affinity to the East and South-east Asia. The situation was explained by Hughes (1975) in the frame of its shrinking Pacific (the phantom of first generation) by the phantom of second generation *i.e.* terrane (Fig. 19). Compare this figure with Fig. 18 b and c.

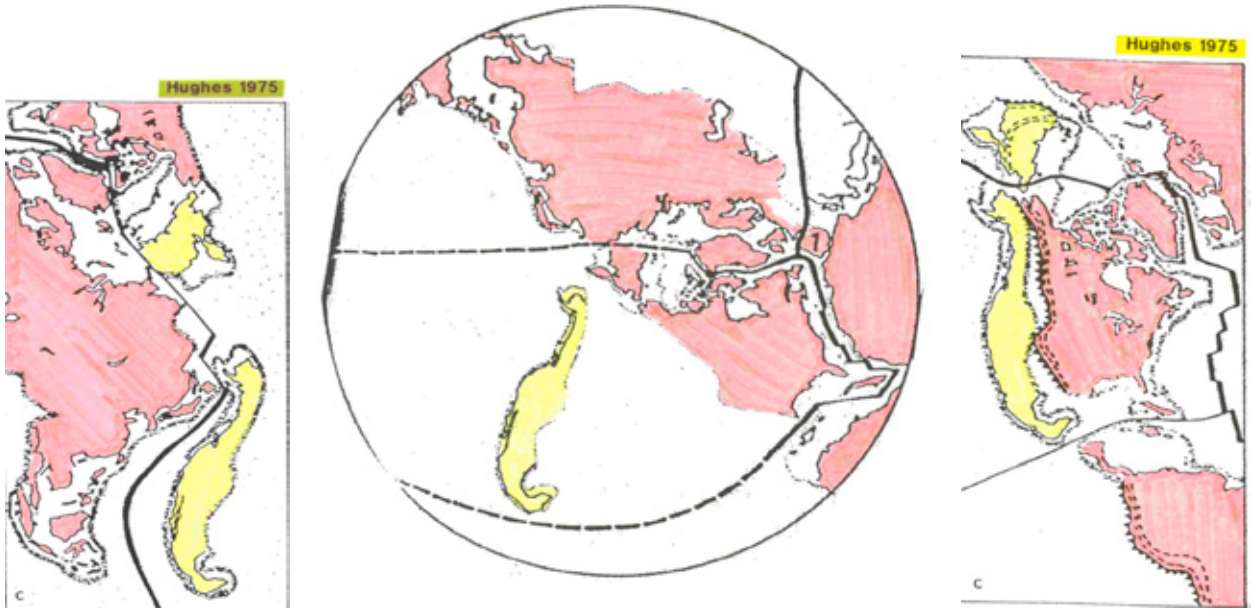


Fig. 19. *Figures by Hughes (1975). Explanation in text*

Later Hughes' single Cordillera terrane was replaced by about one hundred separate terranes.

However the Pacific is an opening ocean as are the others and so the bizarre terrane concept becomes groundless.

In Fig. 19 the terrane circular argument is developed on the closing-ocean circular argument, and this on the subduction circular argument, creating a second extreme multi-storey edifice of circular arguments (Fig. 20).

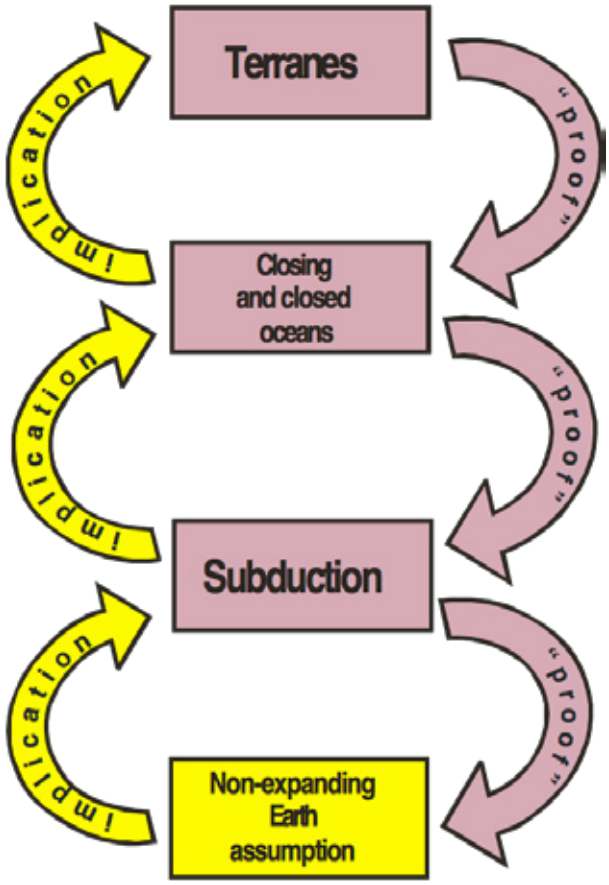


Fig. 20. *Scheme of storey circular argument structure of terrane concept (explanation in text)*

Terrane concept caused extreme damage of regional geology. The former approach of this discipline, consisted on finding connections between neighboring geological units. Today plate tectonicists interpreted majority of geological units as mutually alien terranes, separated in past by broad (now closed) oceans. The majority of boundaries between geological units are to be traces after closed oceans of which the total surface areas is to be hundred folds greater than the surface area of the Earth. Geology lost its sense. Fortunately it restores its sense on the expanding Earth.

12. Plate tectonics models of driving mechanism as a "proof" of plate tectonics

a. Empirical versus causal implication

New phenomena can be implicated on empirical (logical implication from facts) or causal way (physical implication from other phenomena). In the past many of them were recorded on empirical way and only then their causal explanations were found. Justifying a postulated new phenomenon by causal explanation while neglecting its empirical justification is meth-

odologically flawed because one can explain one hypothesis by another one (Fig. 21) creating a quite artificial and false construction.

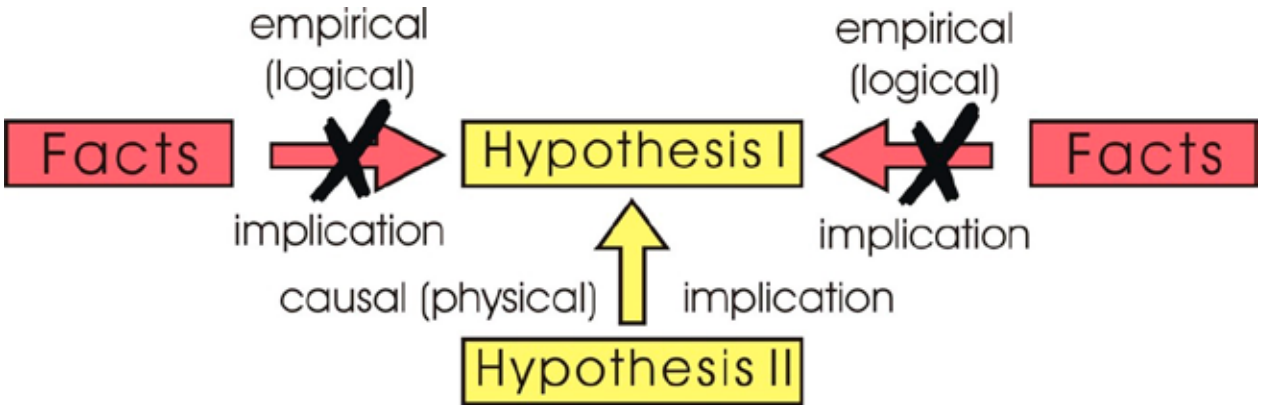


Fig. 21. *At emphasizing of causal explanation it is easy to "prove" one hypothesis by another*

Also a critique of some empirically well-justified new phenomenon on grounds of lack of a causal explanation (Fig. 22) is methodically wrong because such explanations many times were found only after a very long time. In many other cases, such explanations still have yet to be found, though the phenomena have become well established facts. Examples include: Earth's rotation around its axis, the origin of the Earth's magnetic field, polarity inversions of Earth magnetic field.

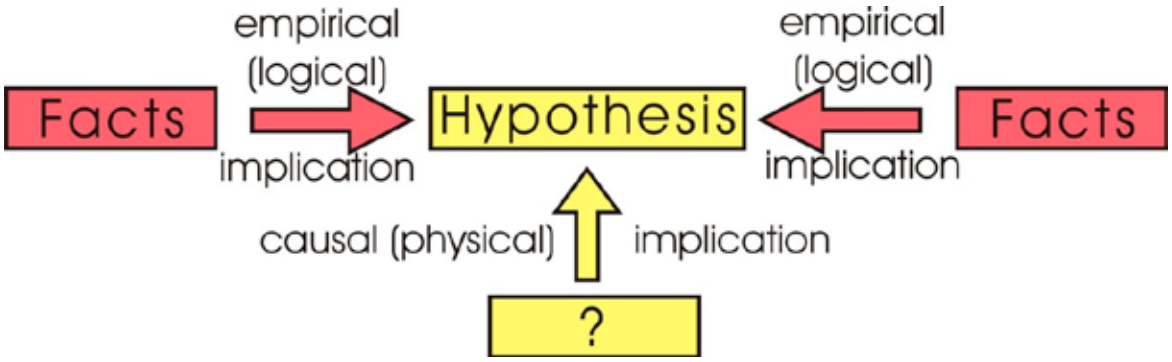


Fig. 22. *Critique of some empirically justified new phenomenon (hypothesis) by lack of its causal explanation is methodical fault*

All these are upside down in plate tectonics paradigm (see the next paragraphs).

In the correct procedure of justifying a new phenomenon (hypothesis) by its empirical implication from facts, there are two possibilities:

1. The hypothesis is falsified and then the problem of its casual explanation disappears (Fig. 23).

Fig. 23. *When the hypothesis is falsified the problem of its casual explanation disappears*

2. Either the hypothesis is verified (proved) and then the causal explanation should be found (Fig.24) though it is not necessary for understanding of the existence of the verified new fact itself.

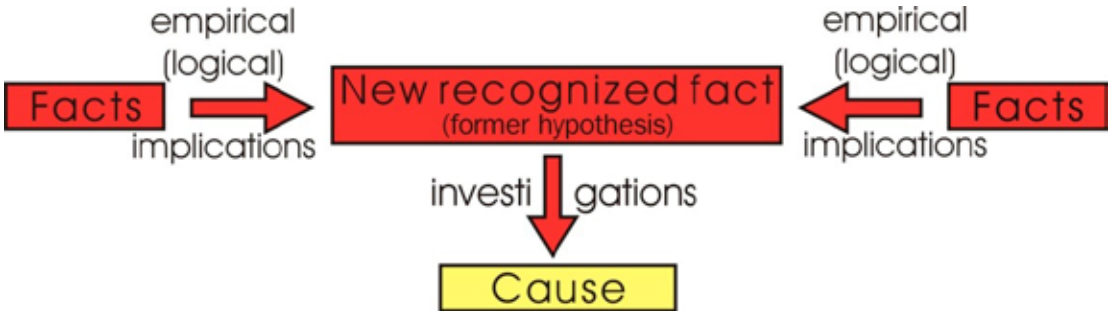


Fig. 24. *When the hypothesis is proved by empirical implication then the causal explanation should be found*

In the second case the problem of causality is treated constructively and the direction of investigation is opposite to the direction of causal implication.

b. Convection currents mythology

At an embryonic stage of plate tectonics that is in the papers by Dietz (1961) and Hess (1962) the main objection against expanding Earth was lack of its casual explanation. On contrary, the main argument in favor of non-expanding-Earth hypothesis and subduction, implicated by the first, was its casual explanation, that is convection currents.

Convection currents made plate tectonics extremely popular. The schemes of rotating arrows in the mantle and subducting slab was enough "to understand" the paradigm. However the incompatibility of hypothetical convection currents with real structures was striking and at last convection currents were replaced by the so-called *ridge-push-slab-pull* mechanism.

c. Alleged ridge-push-slab-pull driving mechanism

This hypothetical mechanism assumes, that the horizontal part of a plate is driven toward an oceanic trench by gravitational "push" generated on the

slope of an oceanic ridge and by gravitational "pull" generated by subducting (hanging) part of a plate. However the descending part of the slab is to be torn off (Fig. 25).

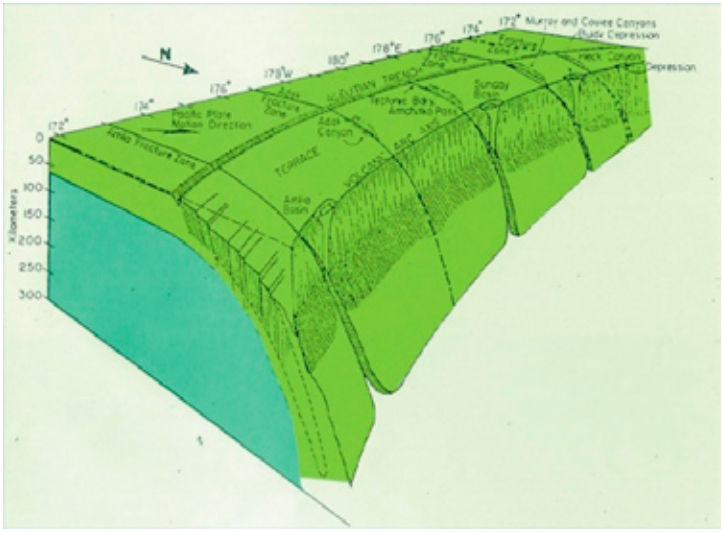


***Fig. 25**. Tearing off oceanic plates at oceanic trenches excludes slab-pull mechanism (after Spence, 1977)*

Thus it cannot pull the horizontal part of the plate. Let us assume however that it is not torn off and thus "pull force" works. Then the whole mechanism should be most effective where the oceanic ridge is high and the distance from the oceanic trench small. However this does not fit reality because the most effective motion (spreading) is there where the ridge is extremely low (vicinity of Easter Island) and the distance (to the Mariana Trench) is extremely big.

Let us now consider the north part of the Atlantic (Fig. 26).

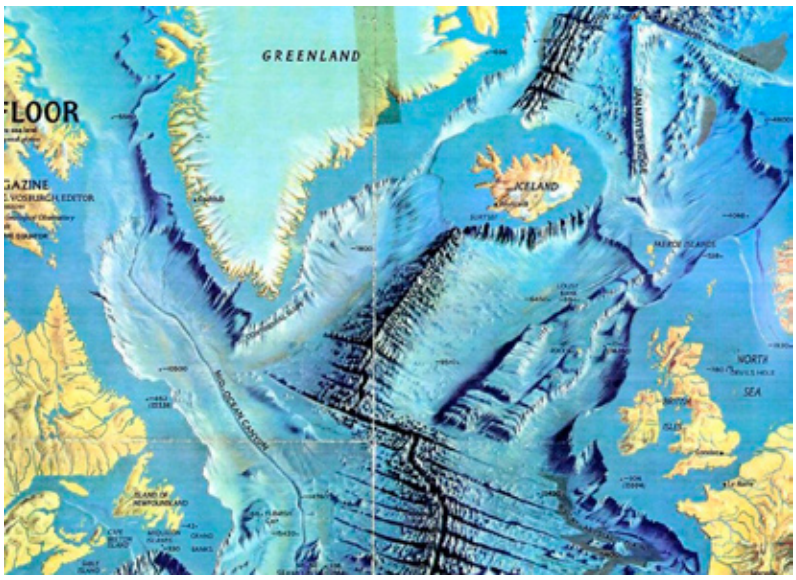


***Fig. 26.** Tectonic relations which exclude ridge-push-slab-pull mechanism (explanations in text).*

The ridge is very high there but its pushing force does not work because the surrounding continental edges have become detached from their parts (Greenland and Rockall block). This could mean that the pulling force at the opposite sides of the plates is extremely high. However at those locations are continental edges not descending slabs. Thus the slab-pull mechanism does not work there at all.

It must also be added that (as it was mentioned) recently the concept of subduction has culminated in the UHPM subduction. However this alleged enormous subduction of continental lithosphere of big buoyancy excludes the slab-pull mechanism, marking a big internal contradiction in the contemporary plate tectonics driving mechanism.

Evidently another force drives the plates – neither ridge-push-slab-pull mechanism nor convection currents.

Let us cite Le Pichon (1968, p. 3673): "*However, if the earth is not expanding, what is the mechanism which results in this pattern of movements?*".

d. Conclusions

It appears at last, that plate tectonics neither results empirically from facts nor causally from its driving mechanisms (Fig. 27).

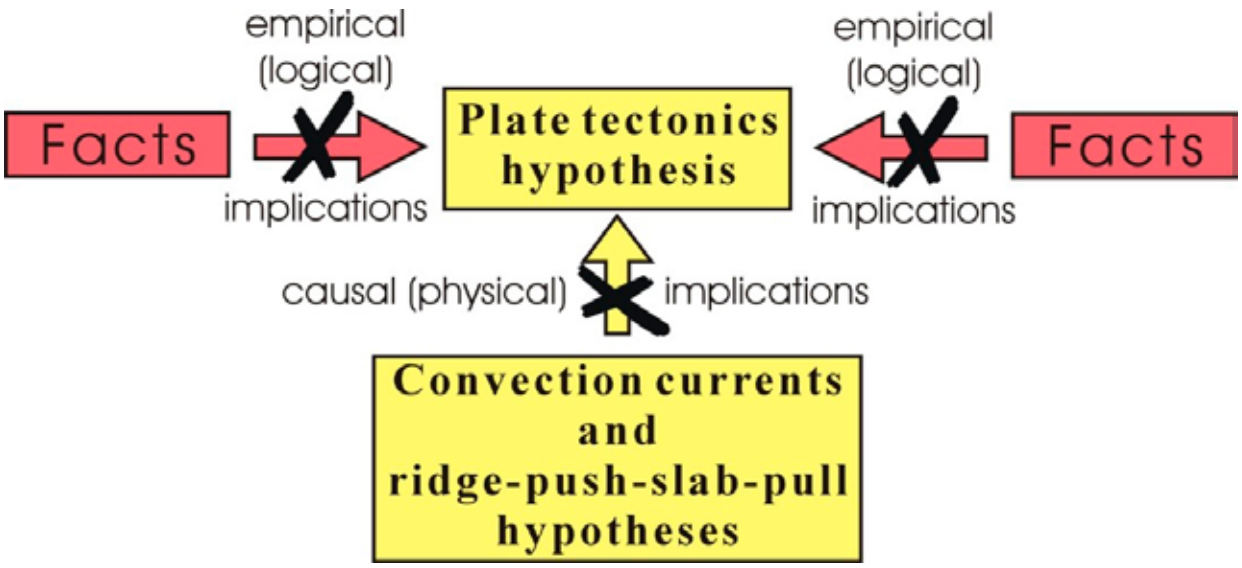


Fig. 27. *Plate tectonics as a theory resulted neither logically from facts nor causally (physically) from some processes*

The only reason for its false driving mechanisms is the real spreading of oceanic lithosphere supplemented by false non-expanding-Earth assumption.

Thus the plate tectonics driving mechanisms, which became a fundament of common faith in this paradigm, can be included to its numerous circular arguments.

IV. Synthesis of cognitive relativism with circularity of reasoning in plate tectonics mentality

In the geology, like in any other scientific discipline, facts can be divided into these of the first importance, the second importance, the third importance and so on (Fig. 28).

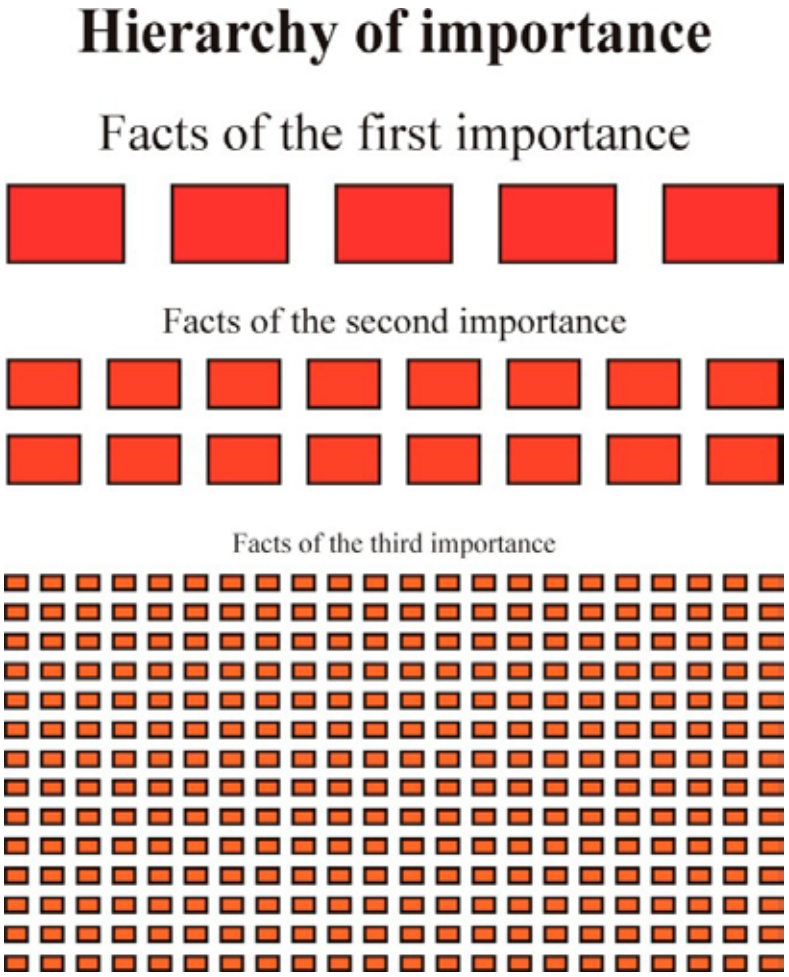


Fig. 28. *Hierarchy of importance of facts in any scientific discipline*

In geology, for example, the fact of first importance is the growth of the boundary of the African plate (Fig. 29) as well as the growth of boundaries of all other plates.

All seven proofs of the Earth expansion mentioned earlier are built on such facts of the first importance.

Fig. 29. *Growth of the African plate's boundary as an example of geological fact of the first importance*

In our understanding of any discipline we can find a contradiction between a fact of the first importance and a fact of lower importance (Fig. 30). The question arises which fact should be revised?

Fig. 30. *Contradiction between fact of first importance and this of lower importance*

In the first step, of course, the fact of lower importance should be revised as suspected being burdened by some false interpretation (Fig. 31).

Fig. 31. *The fact of the lower importance should be suspected of being burdened by false interpretation*

In plate tectonics facts of the lower importance are falsely interpreted on the base of a priori and false assumption of the non-expanding-Earth (Fig. 32).

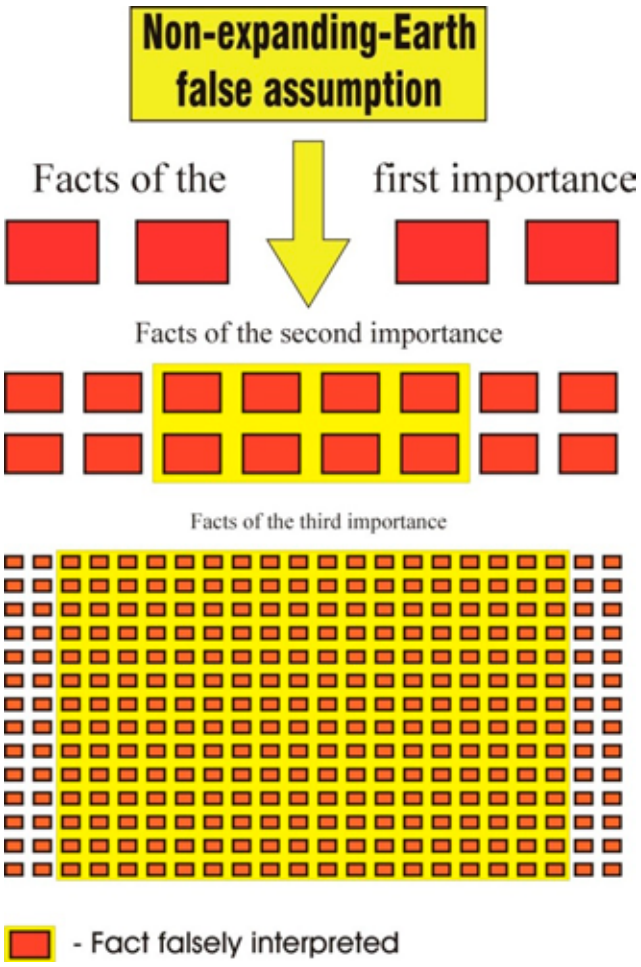


Fig. 32. *Falsely interpreted facts of lower importance (yellow rim) in plate tectonics*

Falsely interpreted fact of the second importance in plate tectonics is, for example, ophiolite sutures as such, interpreted as an alleged traces of alleged closed ocean. Falsely interpreted facts of the third importance are all concrete regional interpretations of this kind of ophiolite sutures.

According to cognitive relativism it is enough to oppose to any theory a tiny fact in order to falsify it. Thus plate tectonicists, driven by this idea, oppose to any proof of the expanding Earth (based on the fact of the first importance), and all them together, any falsely interpreted fact of lower importance. However contradictory relations of these facts to the expanding Earth are generated by circularity based on false non-expanding-Earth assumption. Thus cognitive relativism joins into fatal ensemble with circularity of reasoning. Reasonable discussion with persons, thinking in this way, is impossible. The hope is in much open-minded persons not much trained in plate tectonics. Such persons exist and in quite satisfactory quantity. I ascertained about this during my long practice of lecturing on expanding Earth issues.

V. Conclusions

Plate tectonics is usually praised as the first geological theory which put harmoniously together many different geological facts, processes and disciplines. However this impression originates from a whole series of false models built on the same false assumption of non-expanding Earth. The veritable structure of plate tectonics is that of circular arguments.

In fact the real process which transforms geology into a compatible wholeness is expansion of the Earth. Verification of the expansion of the Earth starts from facts and the expansion is each time a conclusion not an assumption.

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Supplement to the book

The paper rejected by *Nature* on 10 May 2018.
In Nature's system superscripts are cross-references to the list of literature.

Expansion of the World Geodetic Ellipsoid

Jan Koziar*

This paper presents one aspect of my more comprehensive publication *Expanding Earth and space geodesy*[1], which shows that expansion of the Earth emerges from space geodesic measurements and calculations in manifold ways. Among others the major semi-axis of the world geodetic ellipsoid of WGS-84 has successively increased since the first exact calculation in 1989 up to the last such calculation in 2003. However the last result is treated by space geodesists as only the best approximation of a constant parameter. After a lapse of the subsequent 14 years the major semi axis should be about 30 cm longer. Thus the calculations of its length should be repeated again.

At the time of establishment of the world geodetic ellipsoid of WGS-84, the length of its equatorial semi-axis was assessed (after GRS-80 ellipsoid) as 6 378 137 ± 2 meters. In 1989, the value was reduced by better estimation to 6 378 136 meters[2]. Then, based on the increasing accuracy of measurements, the series of precise calculations began. They achieved an accuracy of 1 decimeter and began to record a gradual increase in the length of the major semi-axis. Thus:

1992 – 6 378 136. 3 meters[3]

1996 – 6 378 136. 49 ± 0.1 meters[4]

2003 – 6 378 136. 6 ± 0.1 meters[5]

The increment in the precisely measured length of the major semi-axis between 1992 and 2003 is 30 cm. The treatment of the increment as a manifestation of the Earth's expansion gives an average value of the rate of increase in the Earth radius of 2.72 cm/year. This value is compatible with many other similar values obtained from geological (Table I) and space geodetic (Table II) methods[6,7,1]. Table II, published in two older papers, did not

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include the value resulting from the increase in the world geodetic ellipsoid. The description of all the methods is in the paper[1].

The values in the tables suggest that the real rate of the Earth's radius increase lies in the range 2.0 - 2.5 cm/year. Today, after a lapse of 14 years since the last calculation, the equatorial semi-axis of the world geodetic ellipsoid should be about 30 cm (rounded to decimeters) longer than in 2003. Thus it should be about 6 378 136. 9 meters. This predicted increment for the period 2003–2017 is three times as much as the achieved precision of the measurements.

Table I. Present rates of the growth of the Earth's radius obtained by geological methods

Author	Year	Rate [cm/yr]	Method
Koziar[8]	1980	2.59	Increase in the Earth's surface area (Phanerozoic)
Blinov [9,a]	1983	1.99	Present annual increase in the surface area of oceanic lithosphere
Blinov [9,b]	1983	>1.91	Present annual increase in the Earth's circumference
Blinov[10,c]	1987	≅ 2.0	Increase in the Earth's surface area (Cenozoic)
Osipishin & Blinov[11]	1987	1.96	Increase in the Earth's surface area (Meso-Cainozoic)
Koziar [12,d]	1996	2.7	Present annual increase in the Earth's circumference
Maxlow [13,e]	2002	2.2	Increase in the Earth's surface area (from the Archean)
Koziar[6]	2011	>2.0	Ratio of the lengths of Atlantic Ridge and its African parent margin

[a] correct interpretation of the result obtained by Steiner (1977)[14]
[b] correct interpretation of the result obtained by Kulon (1973)[15]
[c] correct interpretation of the result obtained by Blinov *et al.* (1984)[16]
[d] correct interpretation of the result obtained by Le Pichon (1968)[17]
[e] Maxlow (2005) – book written and accessible in 2002 but published in 2005

Table II. Present rates of the growth of the Earth's radius obtained by space geodesic methods

Author	Year	Rate [cm/yr]	Method
Blinov [10, a]	1987	2.43	Doppler Surveying (general uplift)
Carey[18]	1988	2.08 ± 0.8	SLR (chord analysis)
Maxlow [19,b]	2000	>1.8	VLBI (general uplift)
Koziar [6,c]	2011	>1.0	VLBI (apparent baselines contraction)
Koziar [1,d]	2018	2.72	Increase in the equatorial semiaxis of global geodesic ellipsoid

[a] correct interpretation of the results published by Anderle & Malyevac (1983)[20]
[b] correct interpretation of the results obtained by Robaudo & Harrison (1993)[21]
[c] correct interpretation of the results obtained by Heki *et al*. (1989)[22]
[d] correct interpretation of the results published by McCarthy ed. (1992)[3] and McCarthy & Petit eds (2004)[5]

Expansion of the Earth is since long a real alternative to the plate tectonics paradigm (see for instance my website[23]). Thus it is crucial for both space geodesy and geology that the calculation of the length of the major semi-axis of the WGS-84 ellipsoid be repeated once again.

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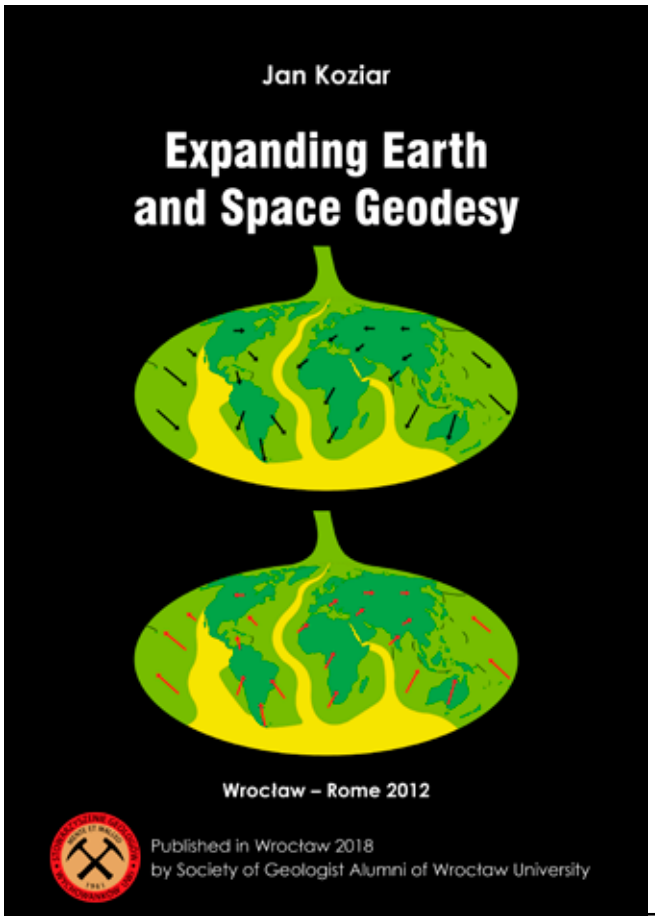

Recommended book

The book ***Expanding Earth and space geodesy*** deals with the most complicated tangle of fiction and reality in contemporary geotectonics. Most geologists do not want to discuss geological facts and relations (belonging to their profession) which prove the expansion of the Earth, because they believe that space geodesy (which is not their profession) has proved the constant size of the Earth. Conversely, space geodesy accepted as a dogma the false geological (plate tectonics) assumption of Eulerian motions of lithosheric plates. These motions can happen only on a constant size sphere. Thus the circularity of reasoning is closed. In the present and above books I demonstrate that this basic assumption of plate tectonics is false.

The recommended book shows that despite the acceptance by space geodesy of the false plate tectonics assumption, the expansion of the Earth emerges from the former discipline in many different ways. Thus the book (available on Amazon) helps to solve the basic problem of contemporary geology. (J.K.)

This book consists of two parts and a supplement. The first part demonstrates that the plate tectonics application of Euler's theorem is wrong and in fact the Earth is expanding. Furthermore, Euler's theorem works only on a constant size sphere and thus all confirmations of the constant size of the Earth based on this theorem are circular arguments. This applies to both plate tectonics calculations based on spreading rates, and geodynamic conclusions derived from space geodesy measurements and calculations. In the second part of the book the circularity of the plate tectonics paradigm is presented with respect to a much larger range of cases. The basis of the circularity is plate tectonics' fundamental - and unproved - assumption that the Earth is not expanding. In fact the Earth is expanding on a significant scale. The present annual increment in the Earth radius, calculated by different methods, is in the range of 2.0 - 2.5 cm. The supplement shows that the major semi axis of the world geodetic ellipsoid expanded at the similar rate as above in the period 1992-2003. Unfortunately, measurements and calculations of the length of the axis ceased after 2003.

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