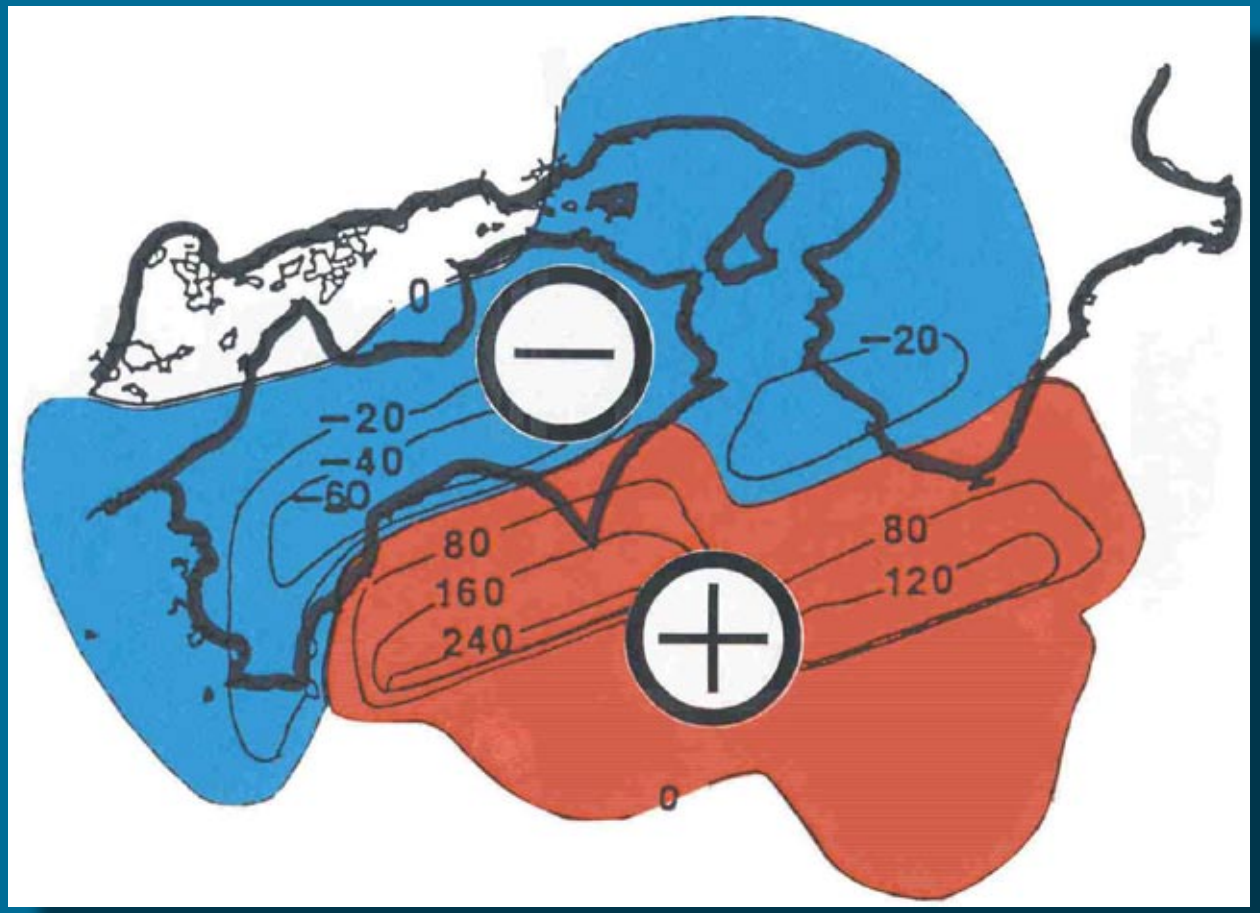
Jan Koziar

Tensional development of active continental margins

(presentation)



Theuern (Germany) 2003
Digital edition, Wrocław 2017

INTRODUCTION (2017)

Subduction model of the triad: oceanic trenches, Wadati-Benioff zones and lines of andesitic volcanoes is a vital part of plate tectonics. However I have shown that the structures mark divergent motion of the adjacent plates and are manifestation of the expansion of the Earth (www.wrocgeolab.pl/margins1.pdf and www.wrocgeolab.pl/margins2.pdf).

The detachment of Japanese Islands from Asian continent had indicated, long before plate tectonics appeared, the divergent motion between Asia and Pacific. Such a tensional interpretation of the development of the Japan Sea has been shown already by Alfred Wegener.

Later concept of subduction is an artificial construction based on a priori assumption that the Earth is not expanding. However a serious problem to explain became the presence of the cold oceanic lithosphere in the Wadati-Benioff zone, pointed out correctly by plate tectonicists.

I was able to decipher a tensional origin of this presence only after studying a paper by Hasegawa *et al.* (1978) about the double planed structure of the Wadati-Benioff zone. Then I recognized the coherent tension-diapiric-gravitational mechanism of the whole structure of an island arc together with a back-arc-basin.

This mechanism was first presented in 1980 in Wrocław and Cracow under a title “Reinterpretation of subduction hypothesis”. In the subsequent 1980s, when I was living in hiding, being wanted by the communist regime, the topic was lectured by my colleague Leszek Jamrozik in co-authorship. It was then the only way to present the topic publicly.

In the 1990s (after the collapse of communism in Poland) I presented the topic personally and it was already included in two lectures: the first was on the primary tectogenesis and the second on the secondary one (according to the known gravitational nomenclature of Erich Haarmann and Rein W. Van Bemmelen). In such a comprehensive way the tensional mechanism was also presented in my course lectures for students in 2000s; see www.wrocgeolab.pl/lectures.pdf (lectures 11 and 12).

After the Erice (Sicily) conference "The Earth expansion evidence" (2011) I recognized better the tensional mechanism (see www.wrocgeolab.pl/falsification3.pdf, Fig. 11), however it has not been yet described. Thus a big gap has appeared between a degree of recognizing of the tensional development of oceanic trenches, volcanic lines and Wadati-Benioff zones and its presentation on my website. The two items placed there, www.wrocgeolab.pl/margins1.pdf and www.wrocgeolab.pl/margins2.pdf , have very limited volume, being only conference abstracts respectively: from Olympia (Greece) conference (1993) and Theuern (Germany) conference (2003). To remedy this inconvenient situation I decided to put the slide presentation of my lecture of the Theuern conference on my website.

Regarding the title of my Theuern presentation "*Tensional development of active continental margins*"

"Active continental margins" means the continental margins with tectonic and volcanic activity. It is descriptive, not a genetic term. These margins are *sensu stricto*: the western margins of South, Central and North Americas and the south-eastern margin of Kamchatka. Plate tectonics widened the category also to island arcs and gave it genetic meaning, treating them as the zones of subduction. Such an approach excluded the western margin of the North America which is active but there is lack of oceanic trenches and Wadati-Benioff zones. The margin developed along the great transform fault. Nevertheless this nomenclature tries to put in one category all the triads: oceanic trenches, andesitic volcanic lines and Wadati-Benioff zones.

In my Theuern paper I followed this range of the plate tectonics nomenclature, showing however that the structures work in line with divergent tectonic mechanism. Unfortunately the nomenclature is not good also because of other reason. Namely it is difficult to count Mariana or Kermadec – Tonga Islands among continental margins. It is why

I later applied the combined term “Island arcs and active continental margins”. However this nomenclature is also inadequate relative to the mentioned western margin of the North America.

Thus the best would be the term “oceanic fold belts” that is the belts which operate with oceanic trenches and Wadati-Benioff zones. Even plate tectonics uses a similar term: “oceanic subduction zone”.

The term “oceanic fold belts” corresponds well with the term “intracontinental fold belts”. Both have similar tension-diapiric-gravitational origin, see: www.wrocgeolab.pl/Carpathians.pdf.

Jan Koziar

August 2017

Many thanks to Professor Cliff Ollier for English correction of my text.

Cover: Areas of subsidence and uplift connected with Nankaido 1946 earthquake

Tensional development of active continental margins

by Jan Koziar

The lecture delivered (without written explanation)
on 24. 05. 2003 at Theuern (Germany) on the conference
„Erdexpansion – eine Theorie auf dem Prüfstand”

The active continental margins are the zones along which, according to plate tectonics, the so called subduction or, in general, shortening of the lithosphere occurs.

The active continental margins are marked by oceanic trenches, volcanic lines and seismic Wadati - Benioff's zones.

At the developed stage they created island arcs and marginal seas.

At the initial stage they are without these structures. The example is the western coast of South America.

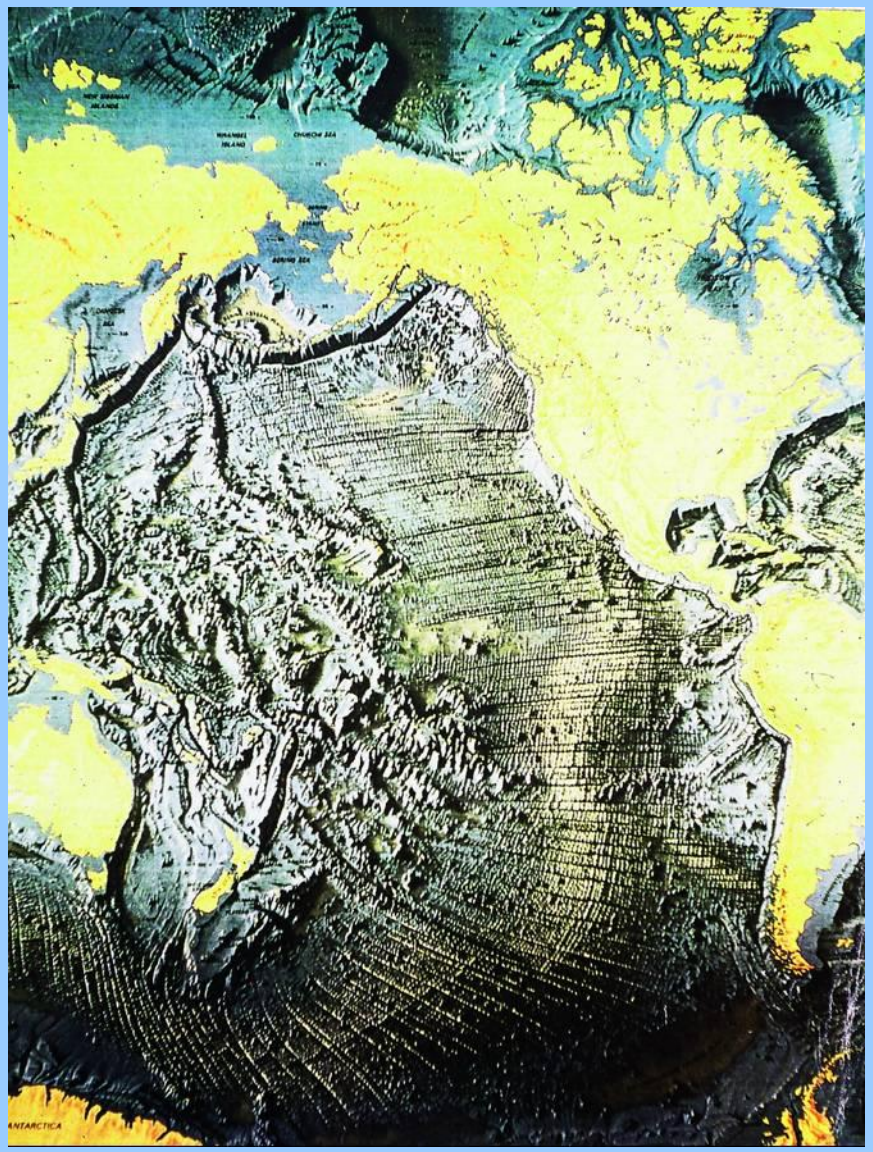
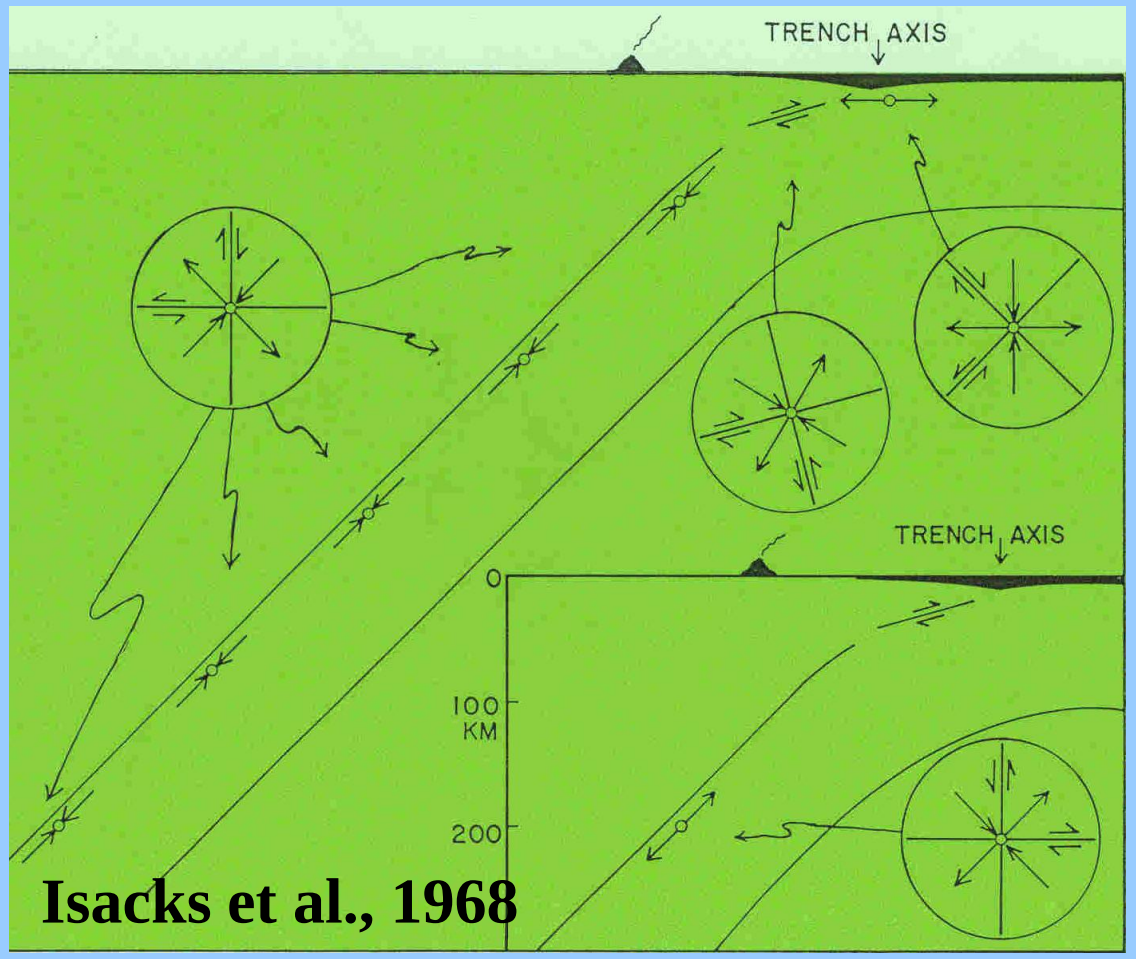
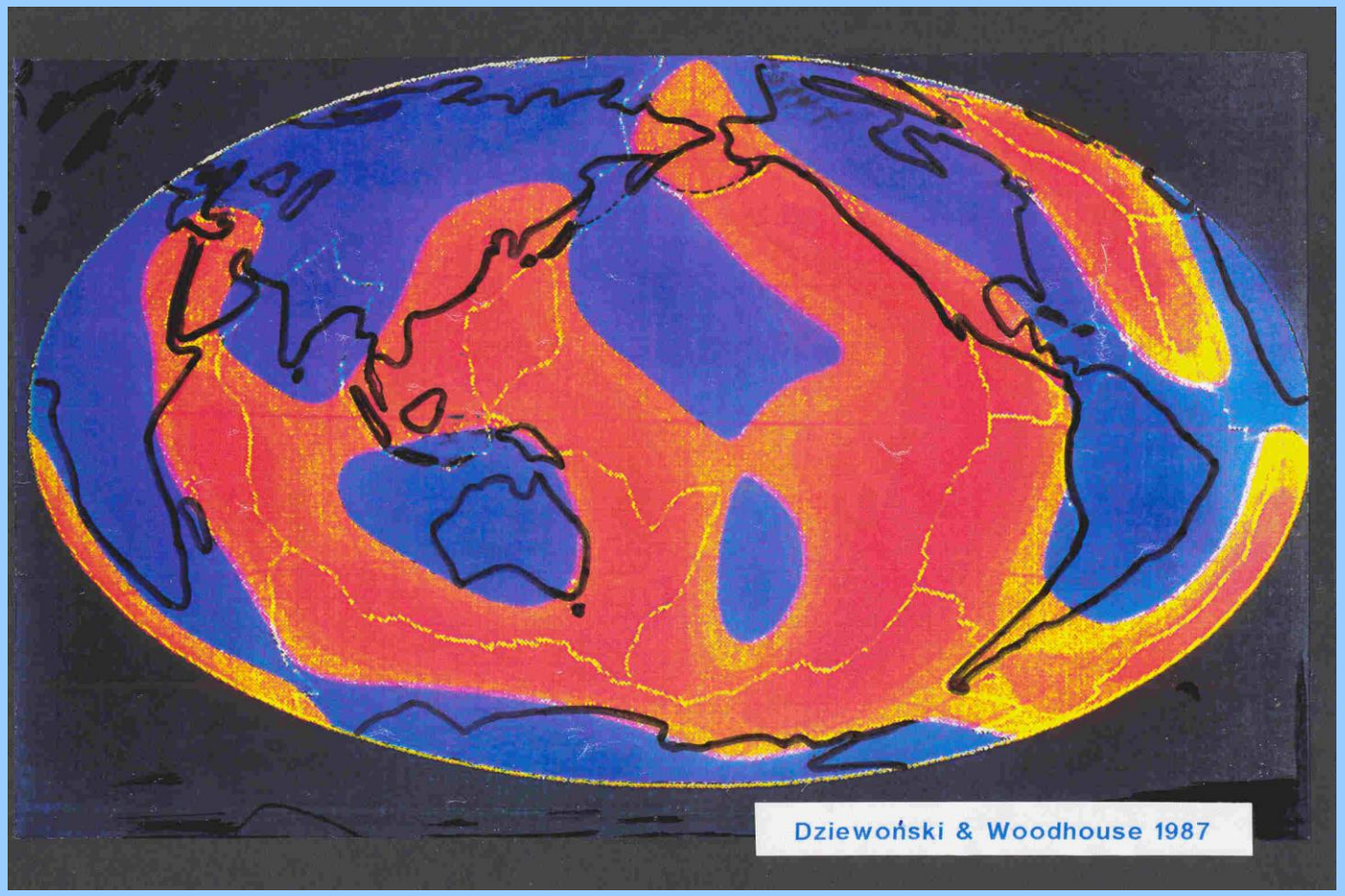


Plate tectonics created a model of active continental margins in which the oceanic plate moves towards a continent. Beneath the oceanic trench the whole plate (of thickness of about 100 km) is bended and moves down into the upper mantle.

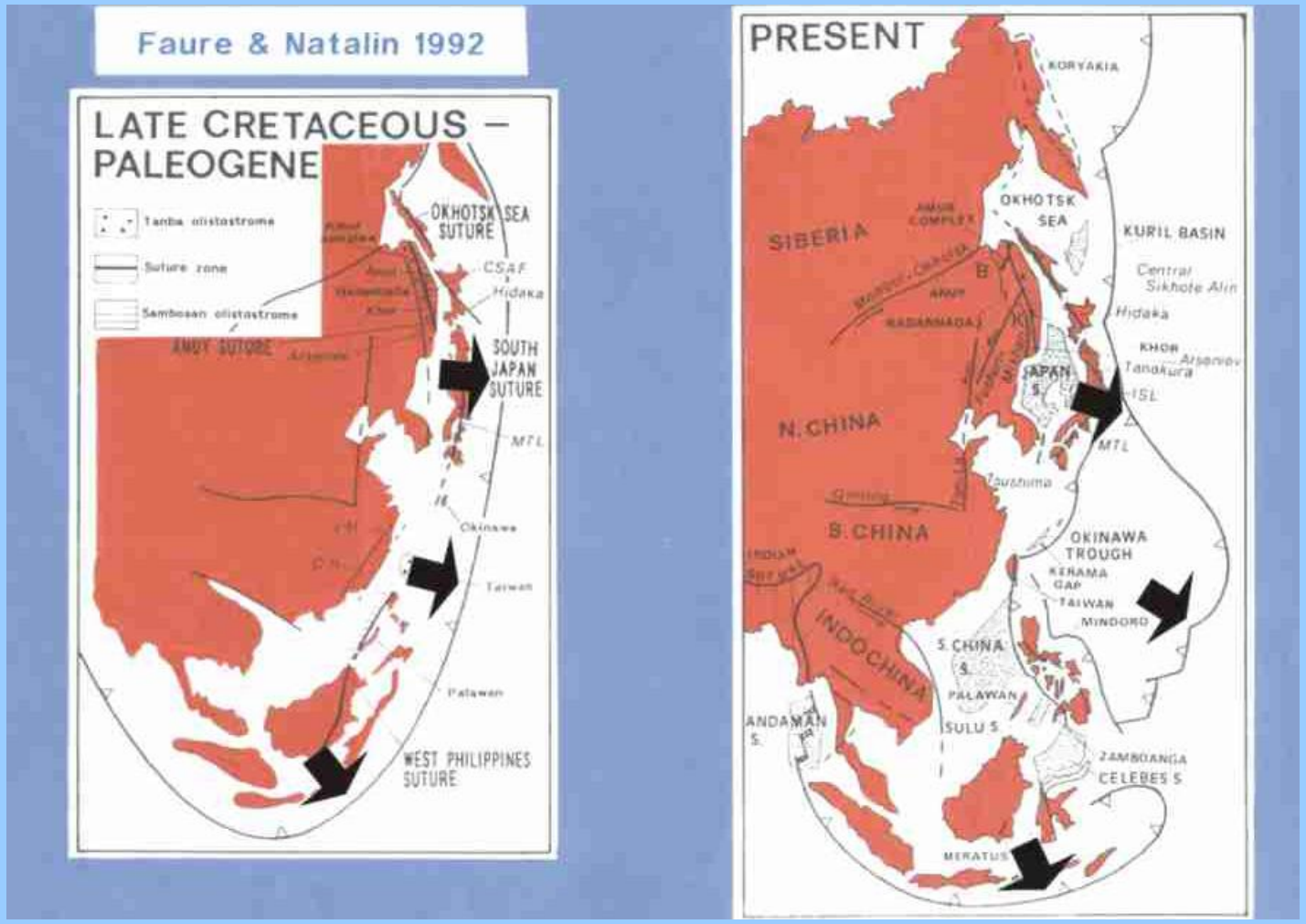


Isacks et al., 1968

The model is in open contradiction with the presence of the heated and thinned upper mantle and its diapirs under the active continental margins. These features of the upper mantle are recorded by seismic tomography, higher heat flow and volcanism.



On this map, made at the depth of 150 km, the blue colour means the cold upper mantle and the red one means the hot upper mantle. We can see, that under the best developed active continental margins, eastwards of the east coasts of Asia and Australia the upper mantle is the same as under the oceanic ridges. And it means tension in general.



At the surface, the former deep tensional regime is confirmed by tensional development of marginal seas and displacements of island arcs from the continents. All island arcs are moving towards the open ocean. The process was for the first time noticed by Wegener and it is a fact definitely proved today.

Speculation above empirical aproach

The question arises, how it is possible to create the model of subduction and insist for years that it is true, in spite of such well visible processes indicating quite opposite plate movements.

The situation results from the specific methodological approach used by the founders of plate tectonics. Namely, they did not analyse particular structures first. And only after such analyses we may go to global conclusions. Just the opposite, they made an a priori global assumption and deduced particular models from it. The assumption is that the radius of the Earth does not change with time. And this assumption has not been proved up today.

The approach is well presented by one of the founders of plate tectonics, Le Pichon:

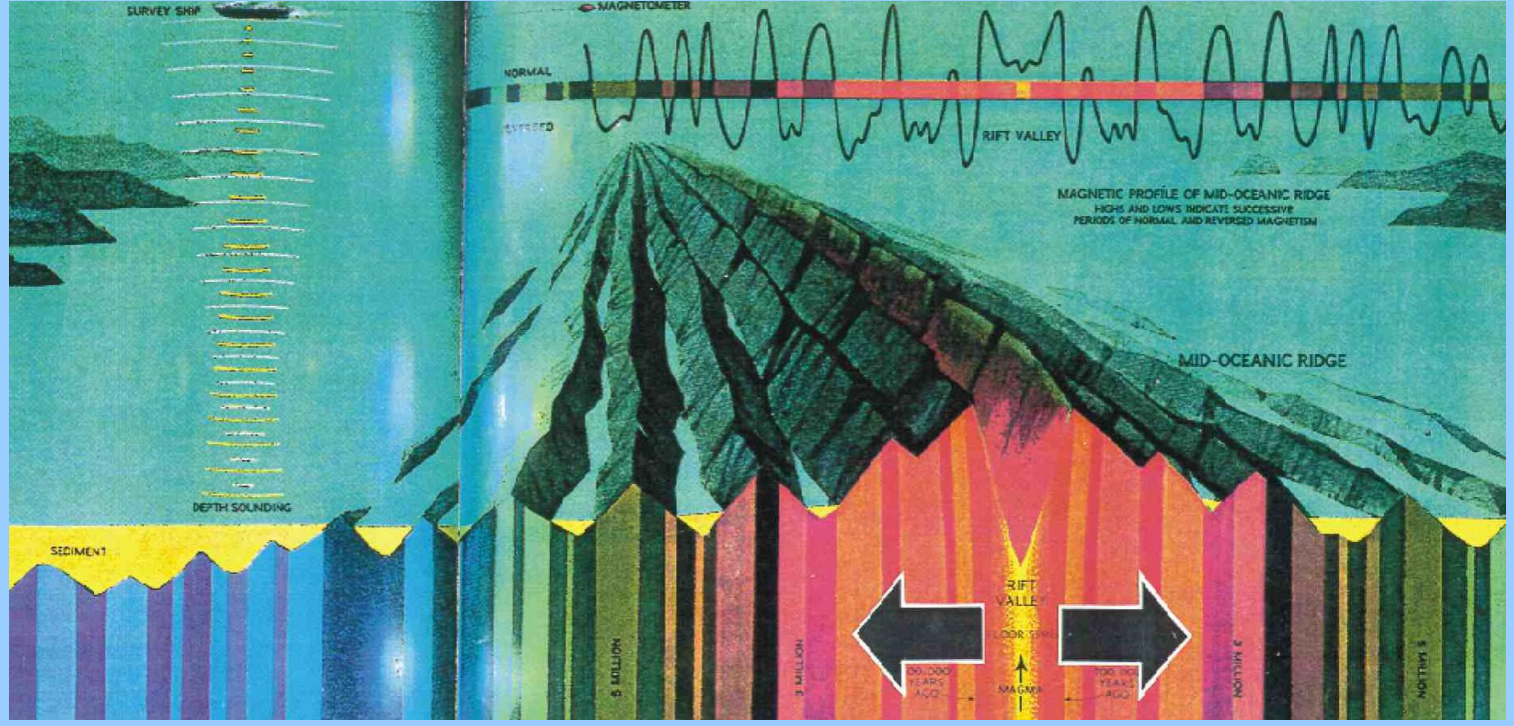
If we assume that the earth is spherical and that the length of its radius does not change with time, we can then proceed to the complete determination of the movement of the major crustal blocks relative to each other.

Xavier Le Pichon
Sea Floor Spreading and Continental Drift
JGR, 1968, vol. 73/12, p. 3674

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

Xavier Le Pichon
Sea Floor Spreading and Continental Drift
JGR, 1968, vol. 73/12, p. 3661

The quotation refers, of course, to the spreading of the oceanic lithosphere on oceanic ridges.



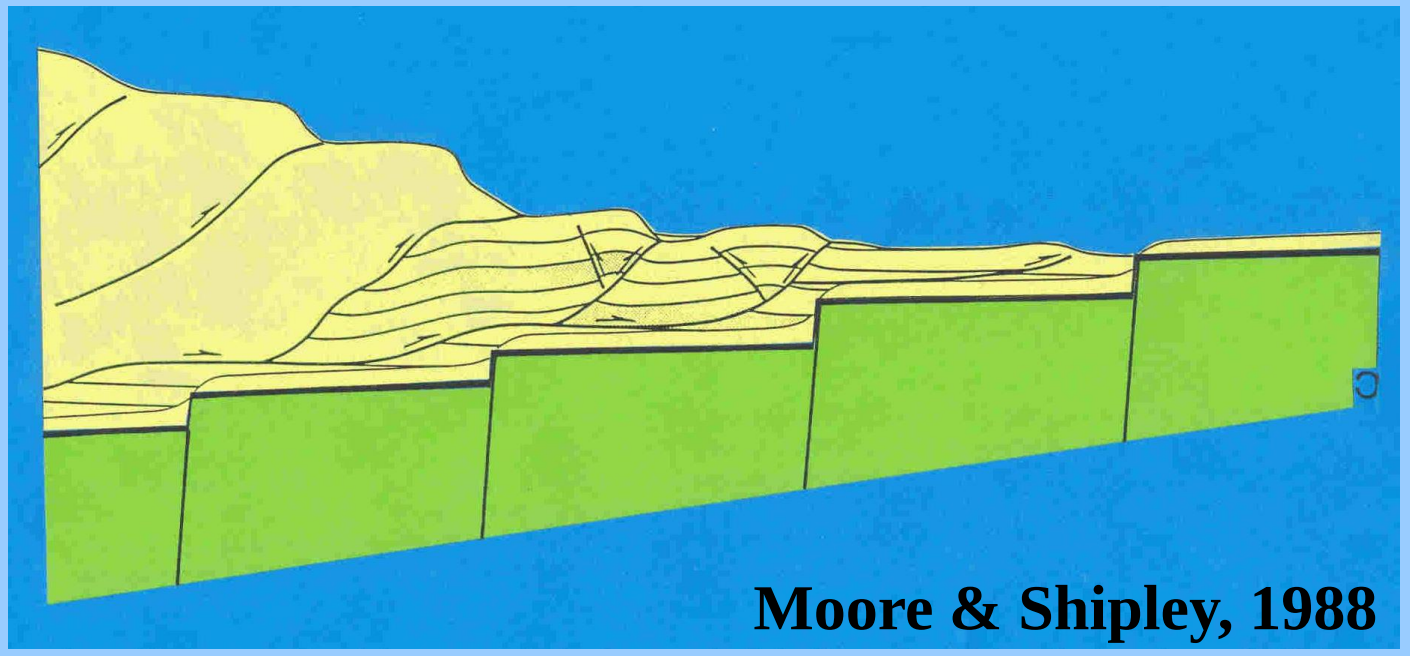
In fact, if the Earth were not expanding the lithosphere created on the oceanic ridges should be shortened at other places.

Empirical (inductive) approach

We will use an opposite methodological approach. We will analyse particular structures first (in this case the elements of active continental margins), and only after that we will be authorized to making a global statment which will have a character of a conclusion, not an assumption.

At the beginning we will analyse the deformation of the oceanic lithosphere under the oceanic trench.

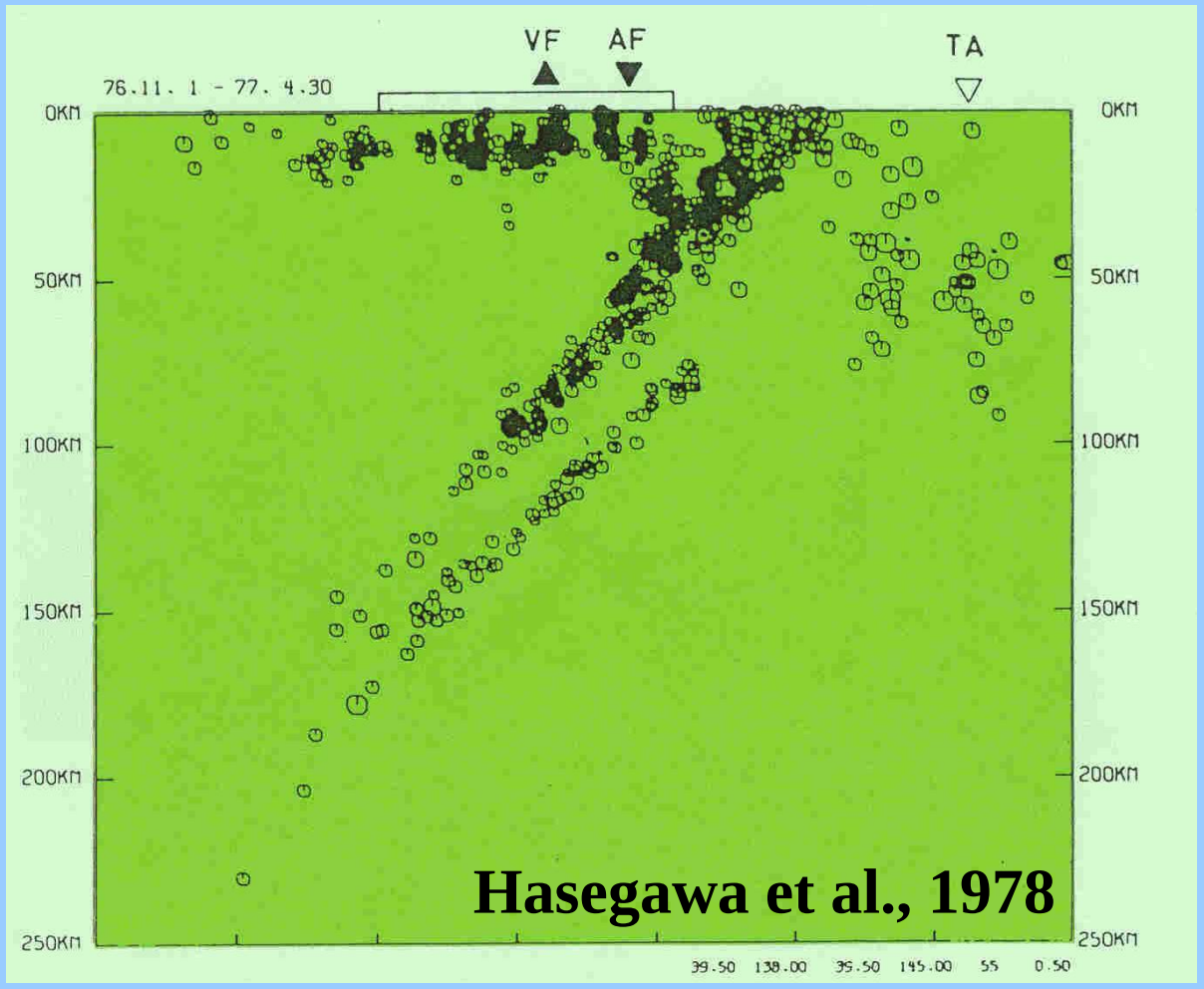
Oceanic lithosphere under the oceanic trench



Seismic profiles, taken across oceanic trenches, show a destruction of the oceanic plate along tensional faults and its stepwise lowering towards the continent. The feature is common to all active continental margins.

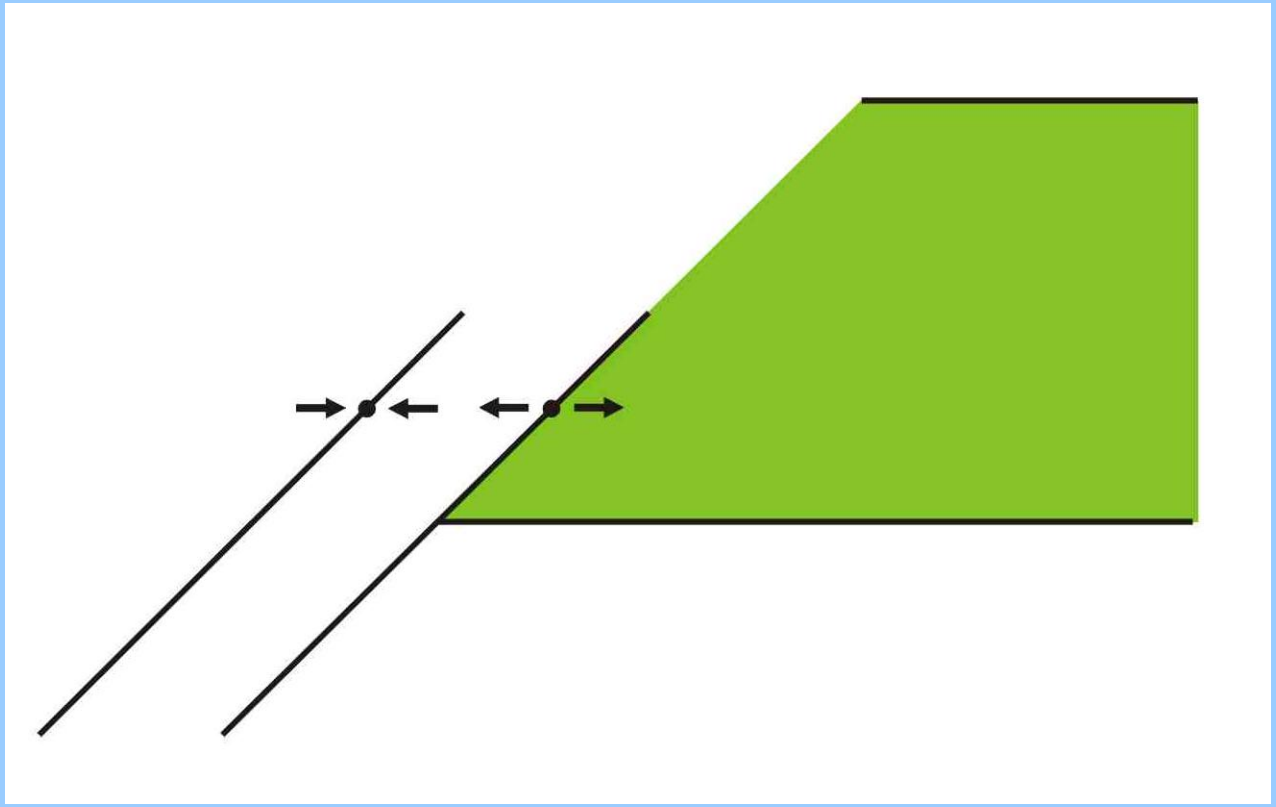
In 1978 Japanese seismologists discovered double structure of the Wadati - Benioff zone:

Double seismic zone



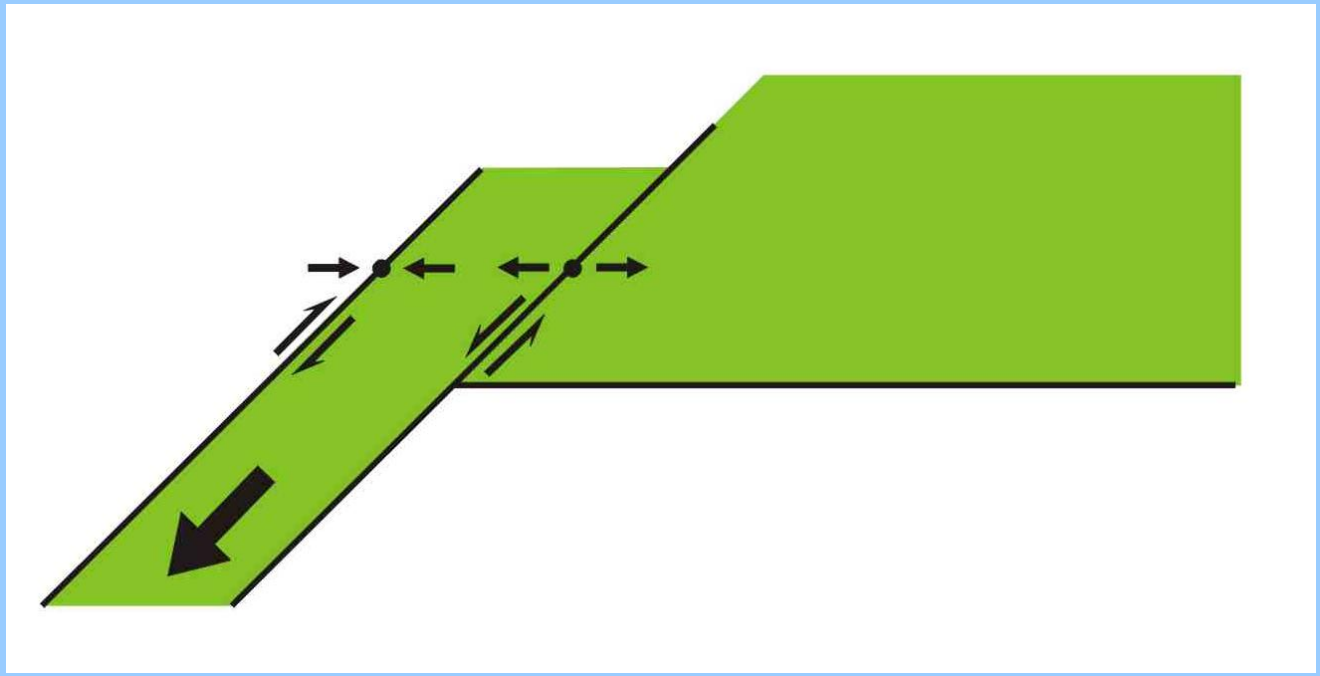
The both planes of the double structure are placed at the distance of only 30 to 40 km from each other. The lower plane riches above the depth of 100 km at which the bottom of the oceanic plate lies. So, there is no bending of oceanic plate.

Horizontal stresses



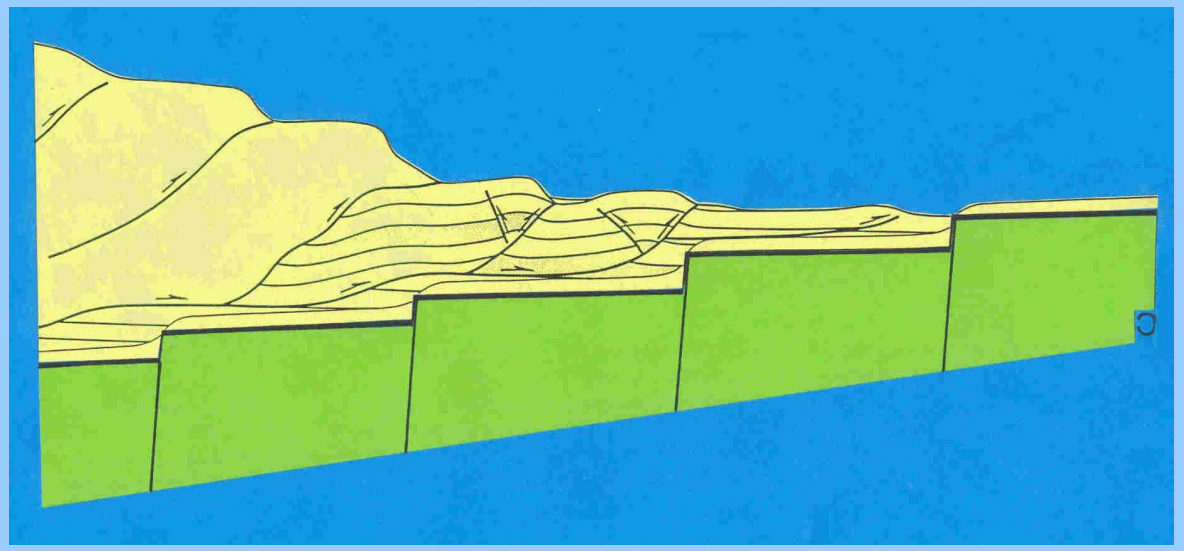
There is horizontal tension at the lower plane and horizontal compression at the upper one.

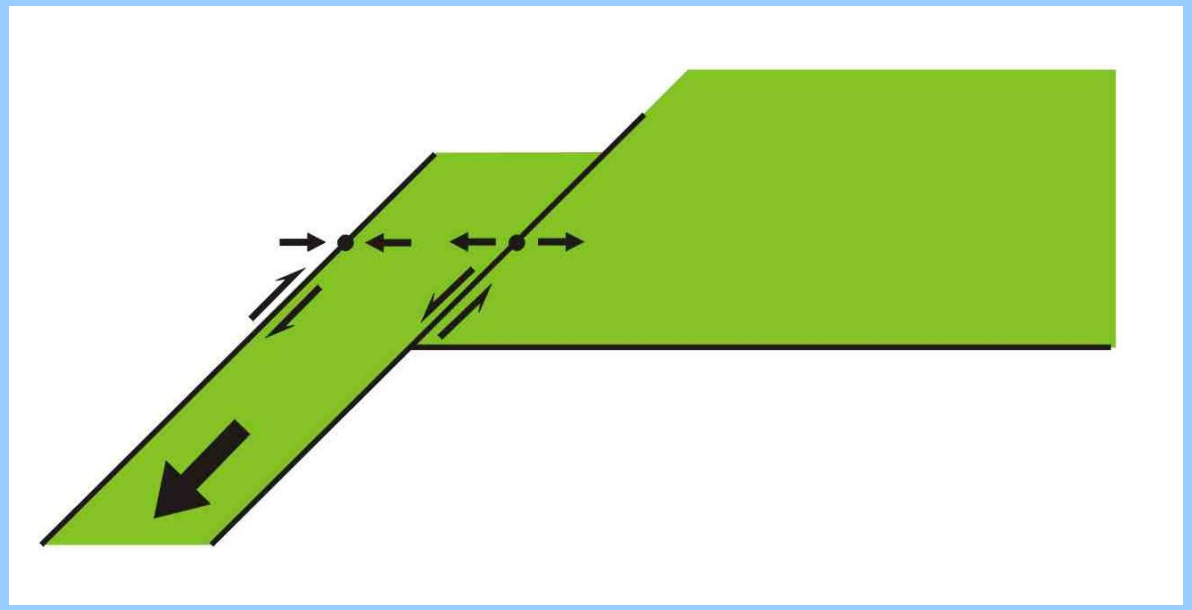
Shear stresses



In tectonics, this pattern of arrows is equivalent to another pattern of arrows which means that all rock masses between both planes move down.

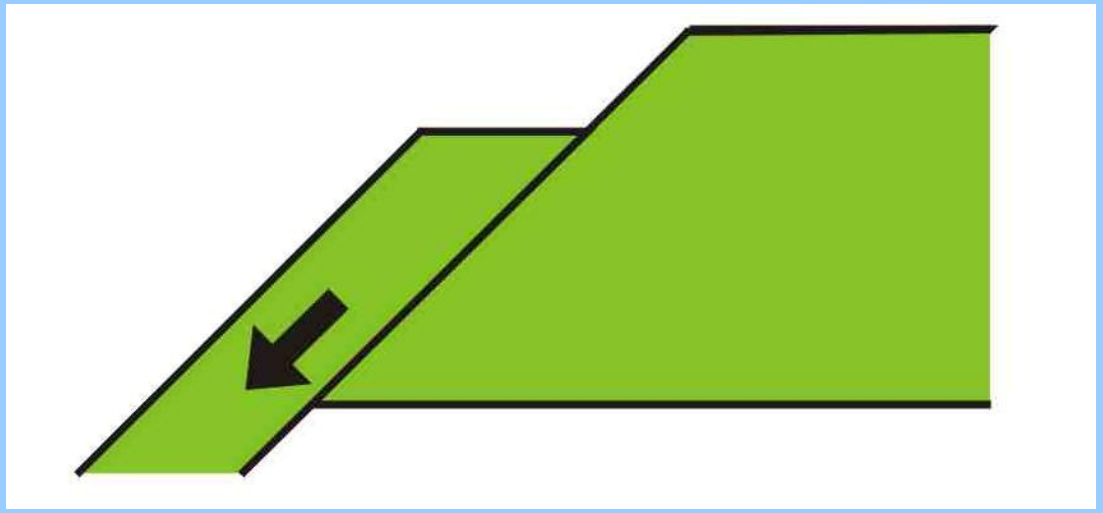
When we put together the former and present schemes....

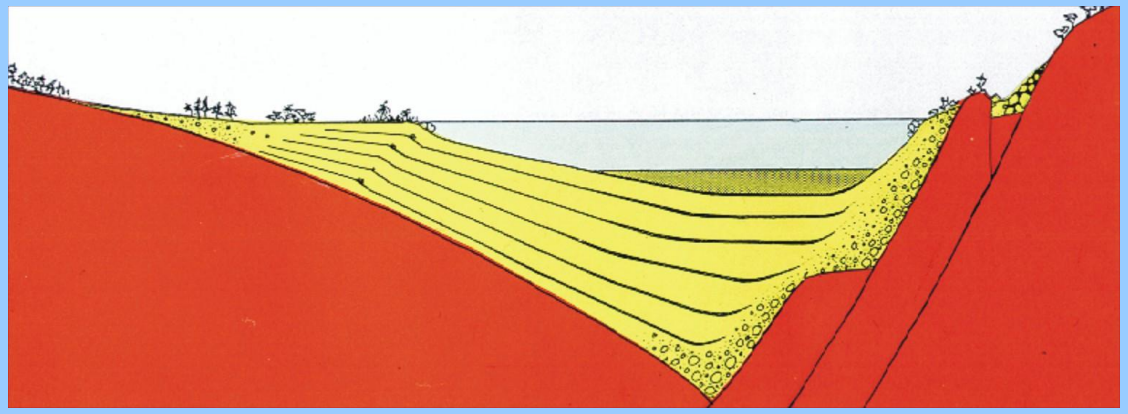




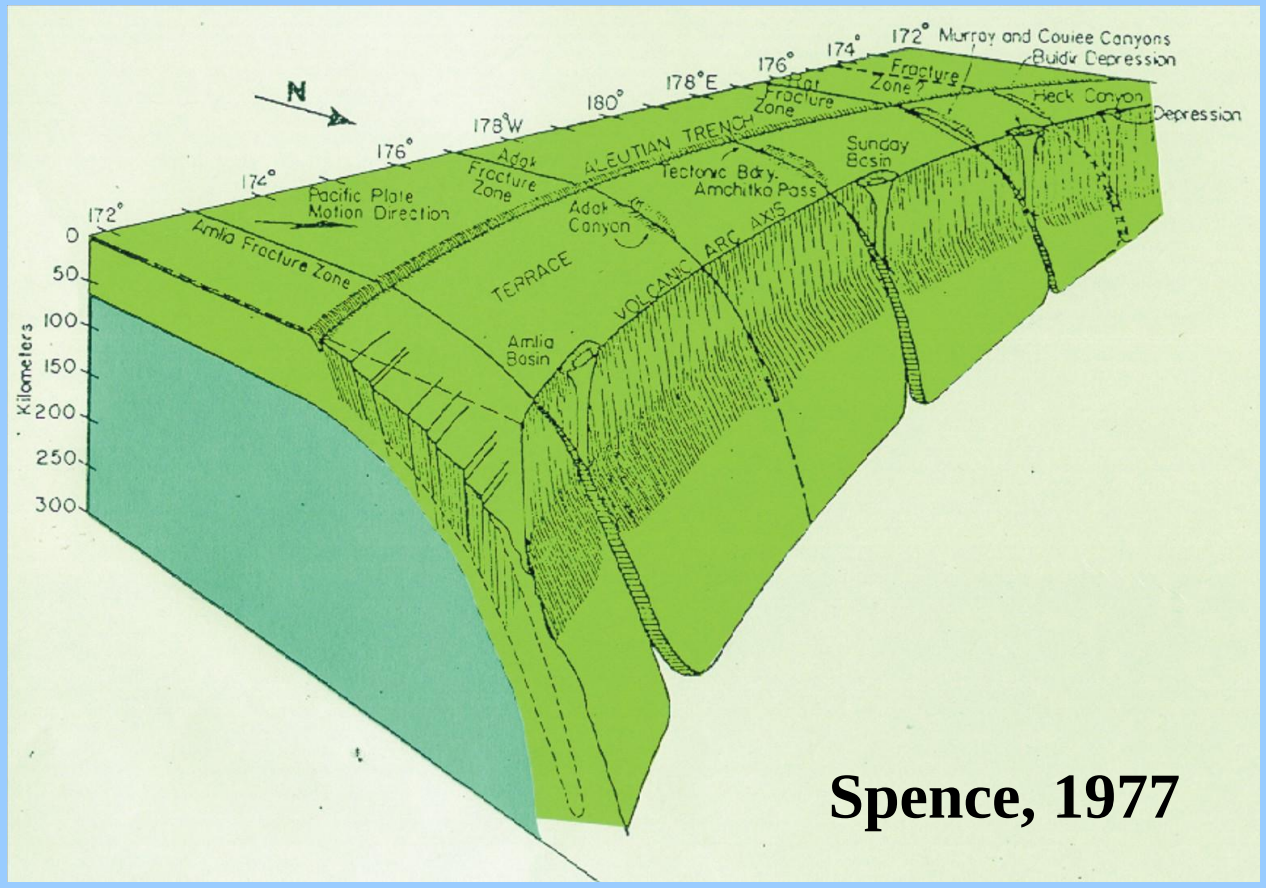
Tensional tectonic halfgraben

....we will obtain a simple structure known in tectonics as a tensional halfgraben

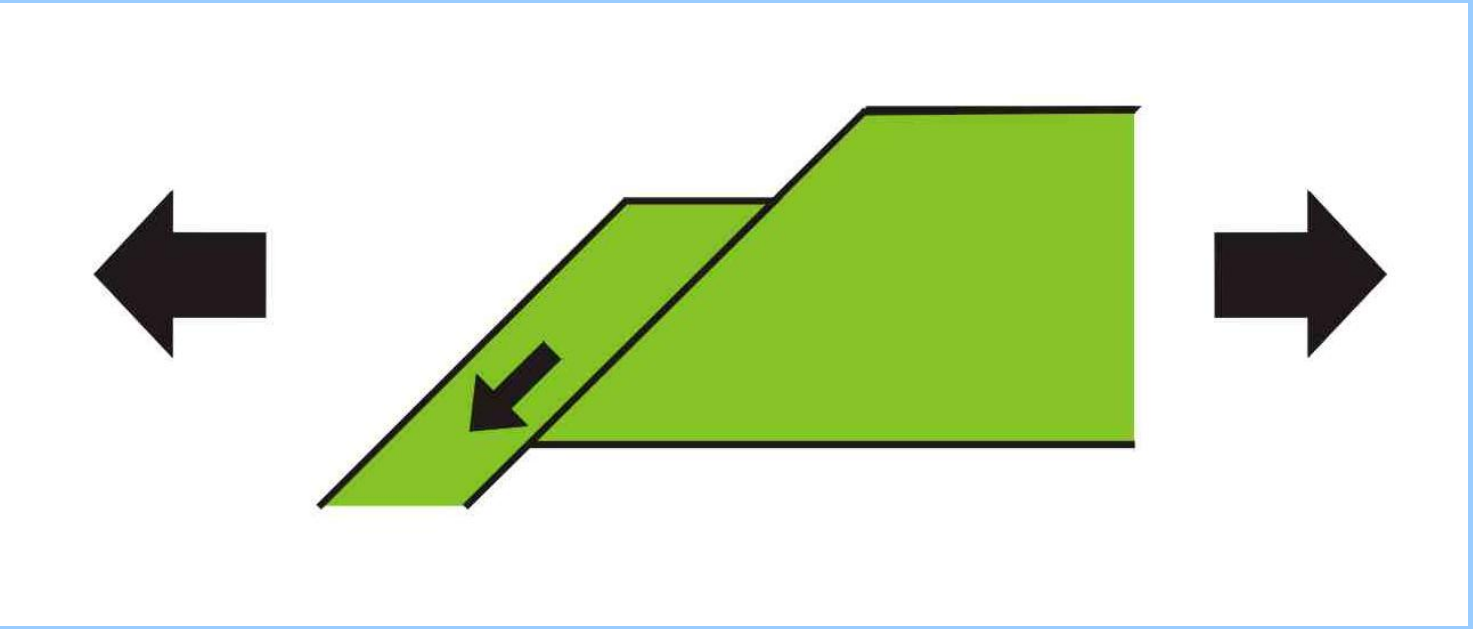




The plate tectonics is close to such interpretation but it has been forgotten that...



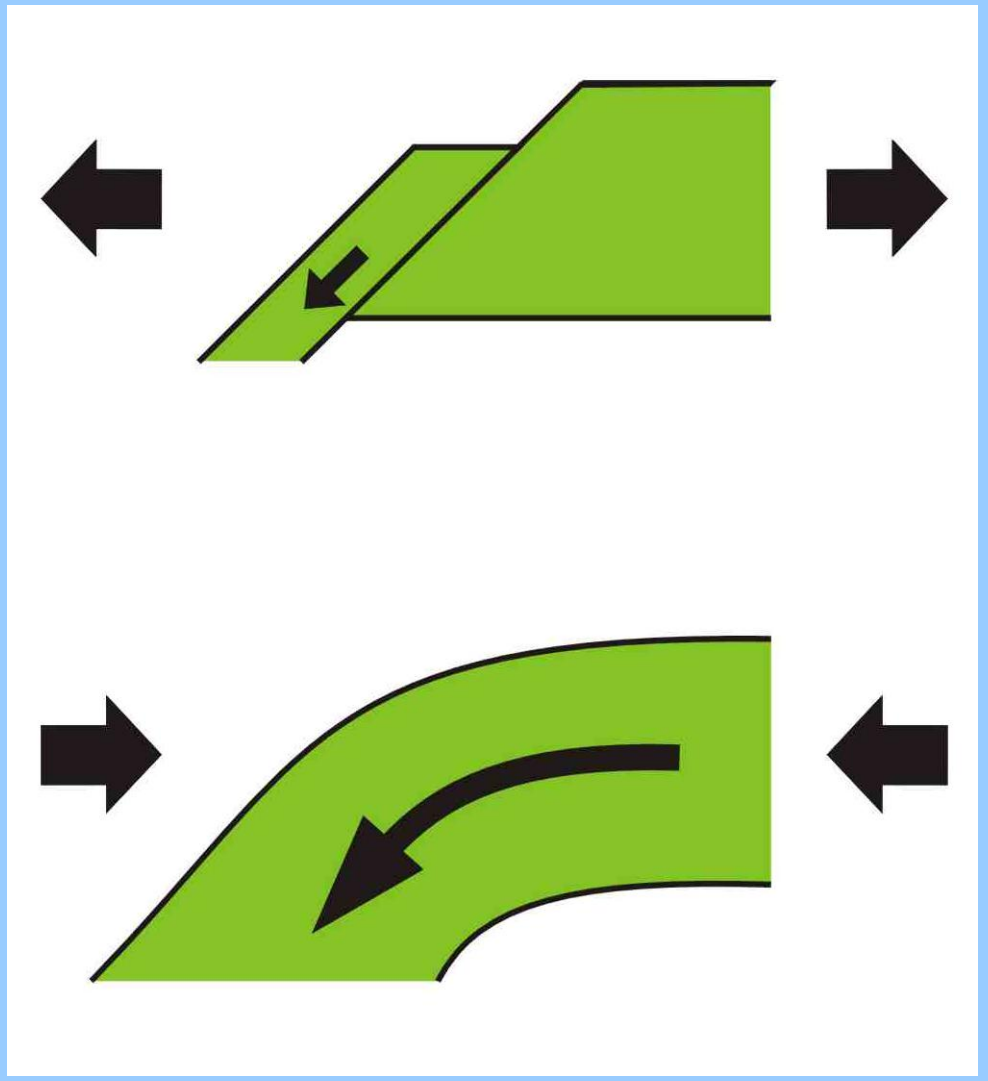
Spence, 1977



.... tensional halfgraben means regional tension

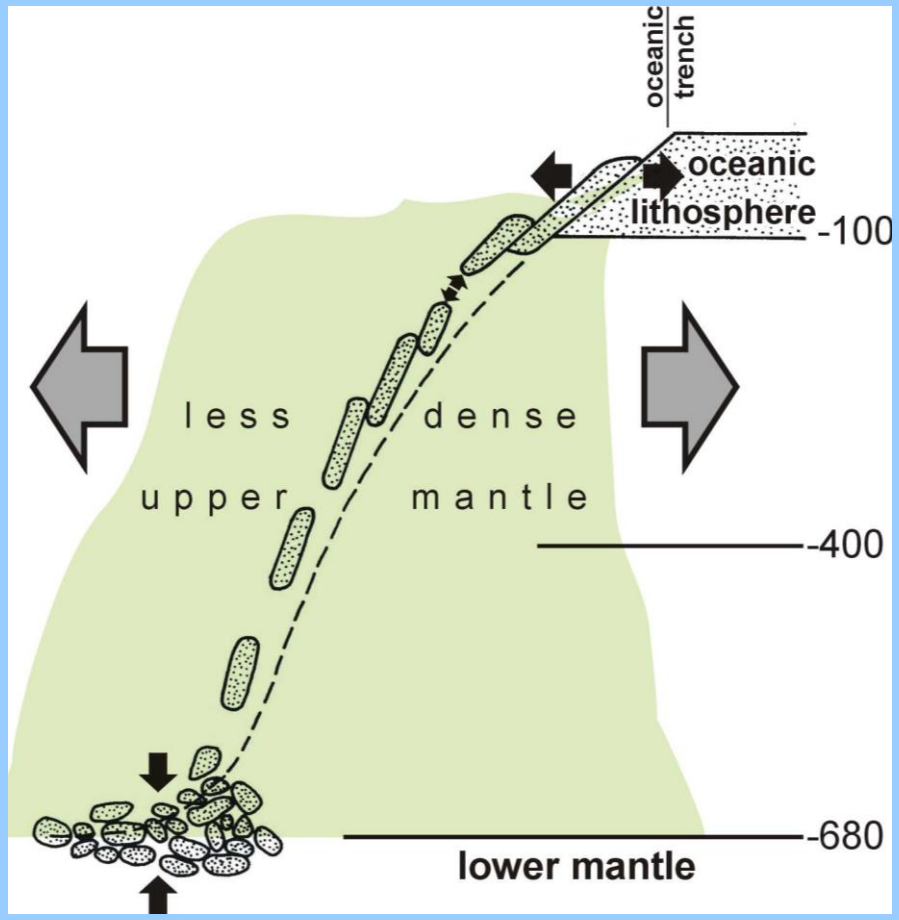
Now, we can compare the real structure of the oceanic plate under oceanic trenches with the model created by plate tectonics. The first indicates the quite opposite tectonic regime than plate tectonics assumes.

What happens deeper with the fragments of the oceanic plate destroyed by tension?



They are sinking in the heated material of the upper mantle mentioned previously.

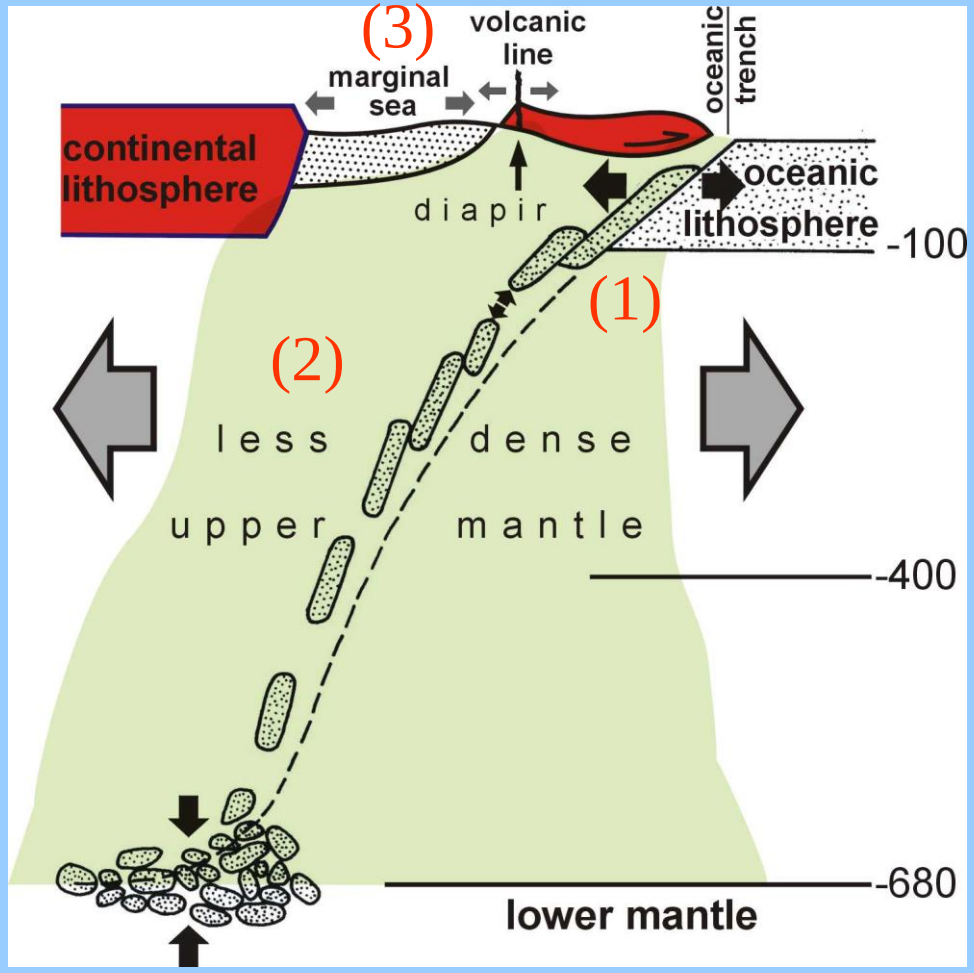
In the process of sinking the debris creates the seismic Wadati - Benioff zone. At the border between the upper and lower mantle the sinking is stopped. The debris floats there between two media of different densities. The density of the debris is between densitiy of the thinned upper mantle and the one of the lower mantle.



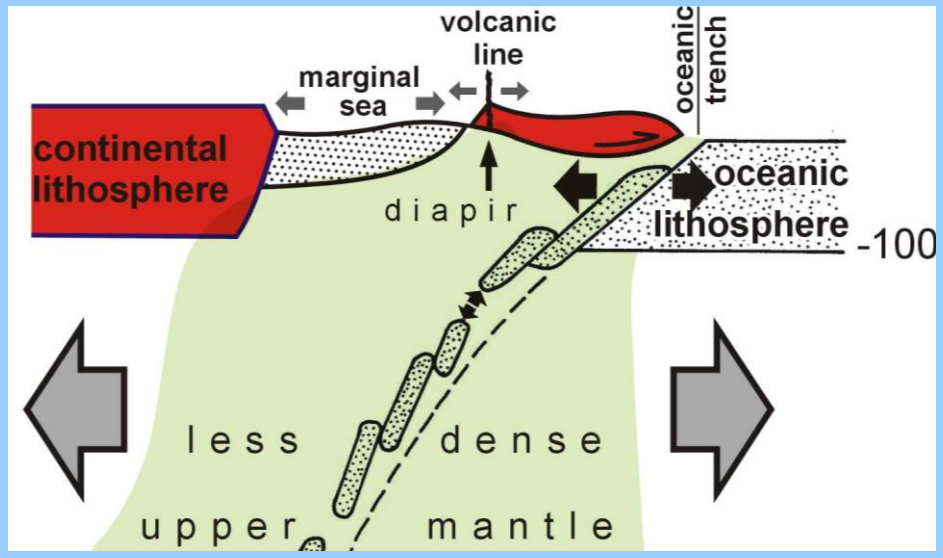
Now we can put together the three main tensional elements of active continental margins:

1. The edge of the oceanic plate, destroyed by tension
2. The heated and thinned upper mantle topped by diapir
3. The tensional marginal sea.

All these structures are mutually compatible and all together indicate drawing aside of the oceanic and continental plates.



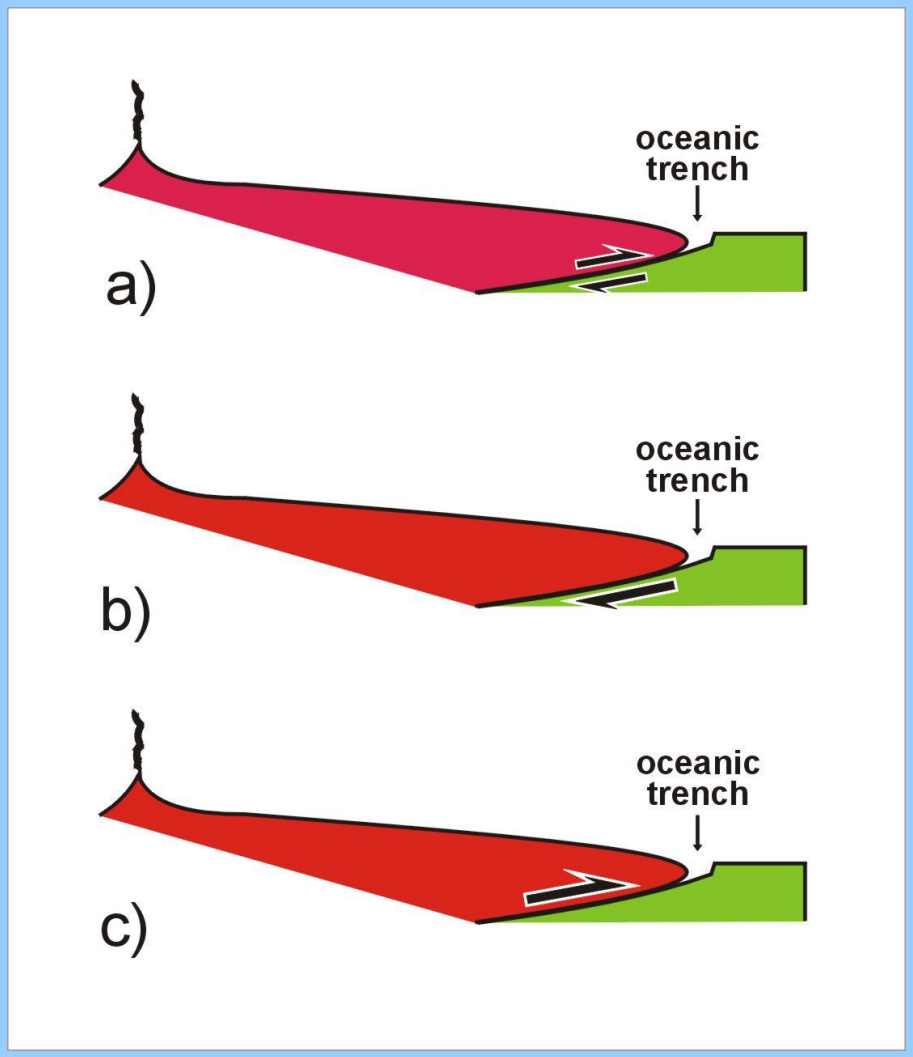
Between the top of the hot upper mantle (marked by the volcanic line) and the oceanic trench, the island arc is placed. In such a position the arc will have a tendency to gravitational gliding towards the oceanic trench.



The process of such kind was predicted by the German tectonists Erich Haarmann in the thirties of the last century.

Now, we are going to prove this predicted process.

The so called shallow earthquakes, under the frontal part of the island arcs, indicate following relative movements:



These arrows (a) mean either underthrusting (b) of oceanic lithosphere under the island arc or overthrusting (c) the island arc on the oceanic lithosphere.

The plate tectonics chose the first possibility (b) without any discussion of the second one (c).

However, it can be proved that just the second possibility is true. In other words, it can be proved that during the shallow earthquakes big parts of the island arcs transform themselves into huge landslides.

That is a process like this.

According to plate tectonics paradigm the road (visible in the picture) is subducted under the slope. Another possibility is not considered.

We will prove that during the shallow earthquakes big parts of the island arcs transform themselves into huge landslides. We will do it considering horizontal and vertical displacements of the areas between volcanic lines and oceanic trenches.

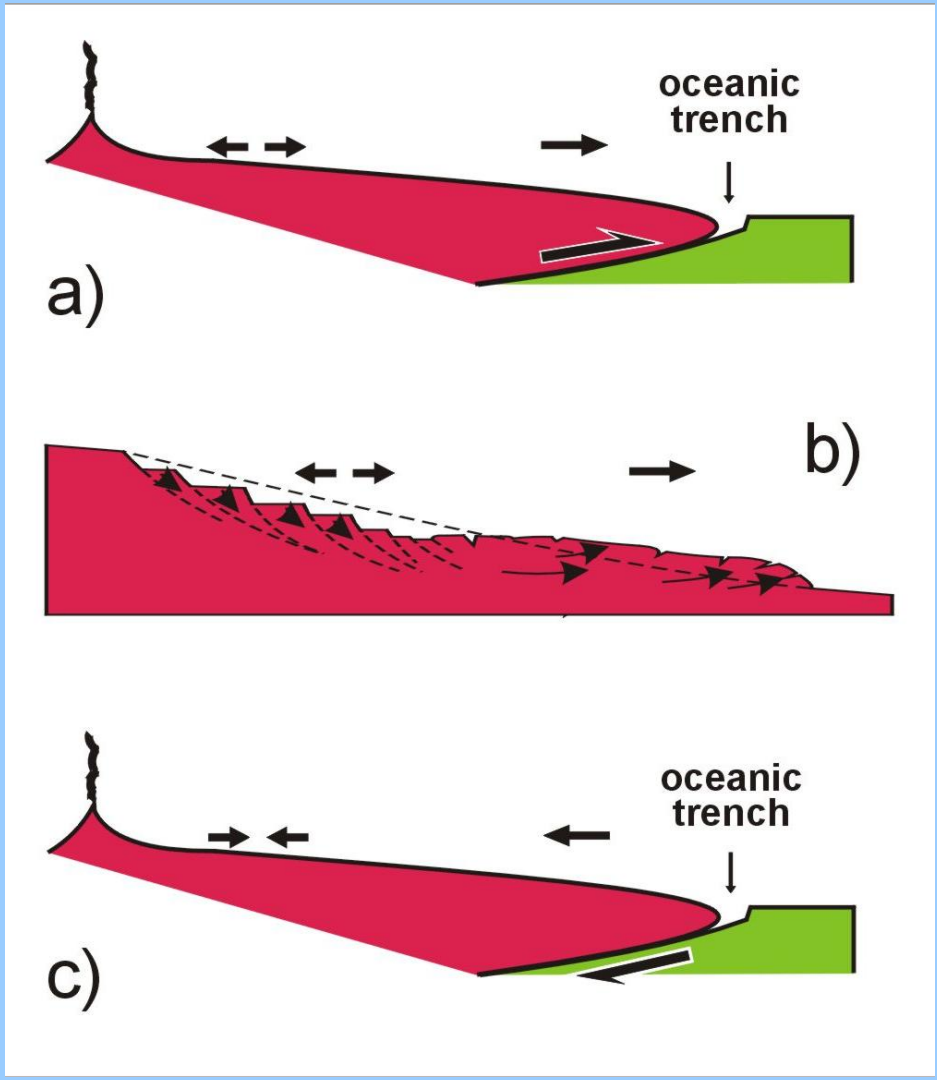
Let us begin with the first ones.

Horizontal displacement

The horizontal displacements are like these ones in figure (a)

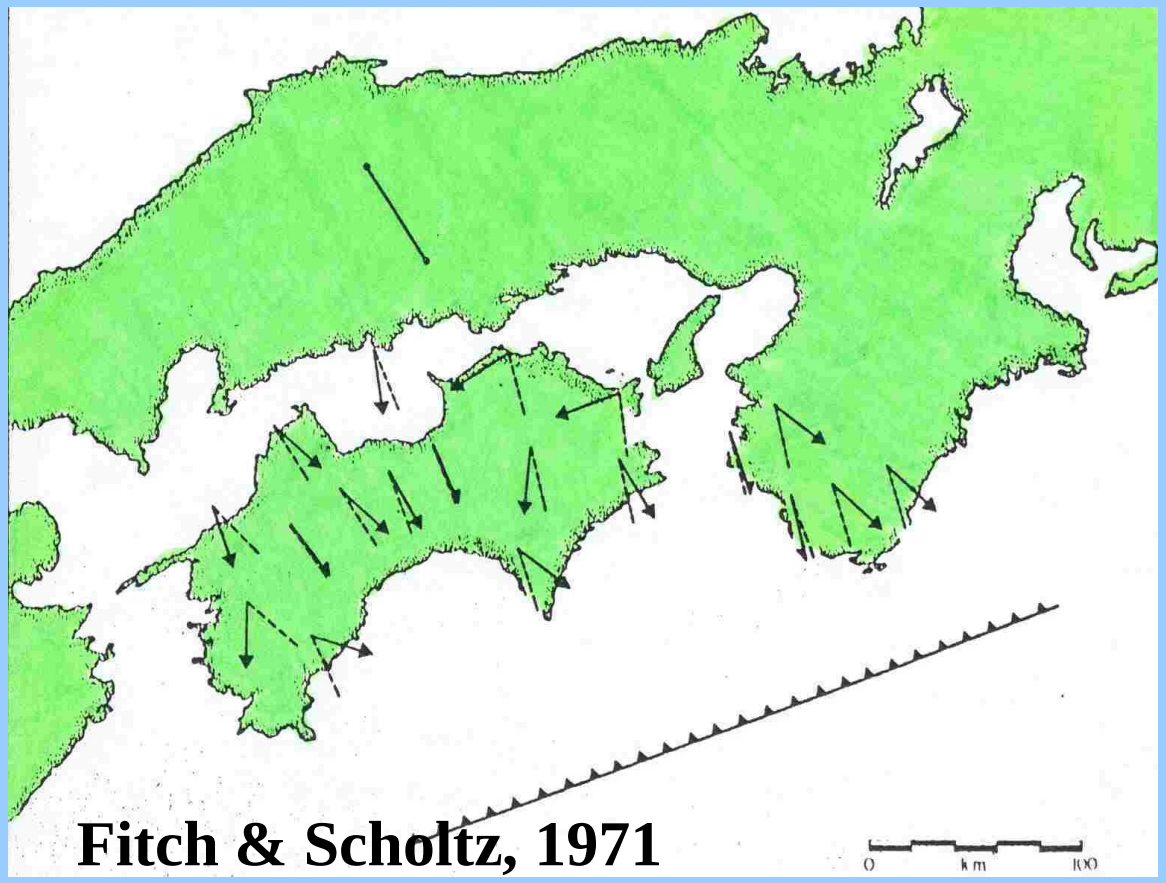
and they are exactly like in the case of landslides (b)

According to plate tectonics model they should be like these (c).



Now we will demonstrate the landslide patterns of horizontal displacements on the examples of three famous earthquakes.

The first is the Nankaido earthquake of 1946:



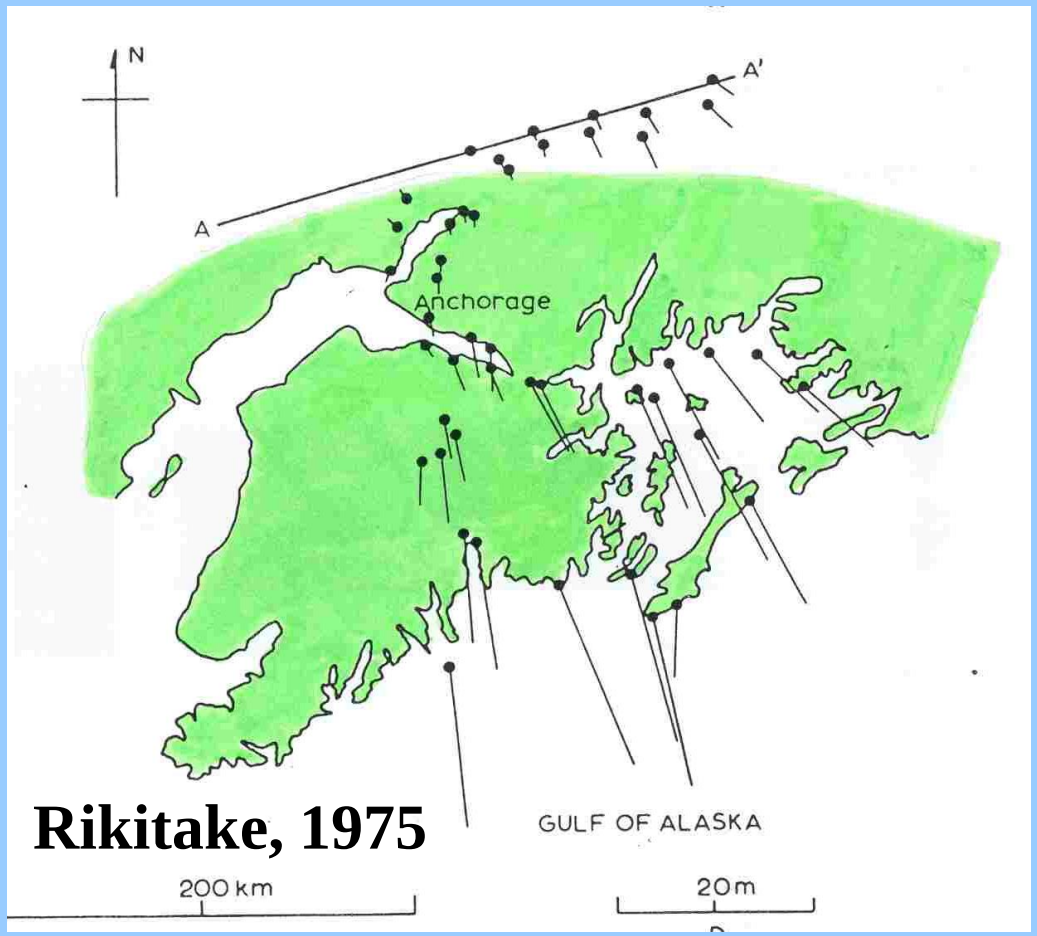
Fitch & Scholtz, 1971

Nankaido 1946

The whole frontal part of the island arc, especially the Shikoku island, was shifted towards the Japanese trench.

The displacements were measured relatively to the geodetic base placed on the main island Honsiu.

The second example
is the Alaskan earthquake of
1964:



Rikitake, 1975

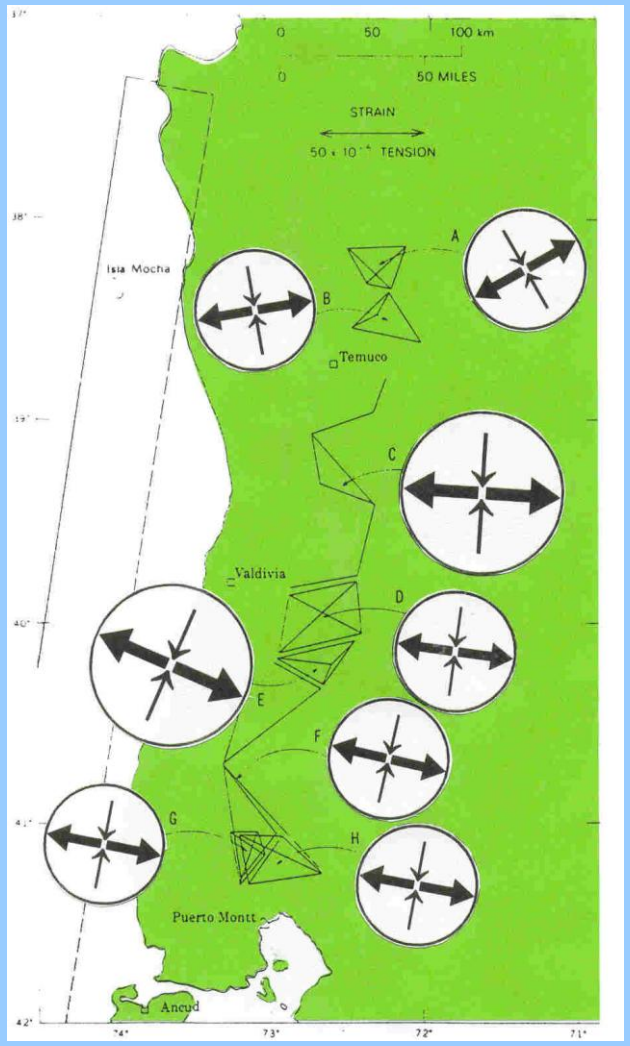
Anchorage 1964

The Kenai Peninsula and its vicinity was shifted towards Aleutian trench.

The more frontal part, the greater the displacements are. It is exactly like in landslides.

The third example
is Chilean
or Valdivia earthquake of 1960:

Plafker & Savage, 1970

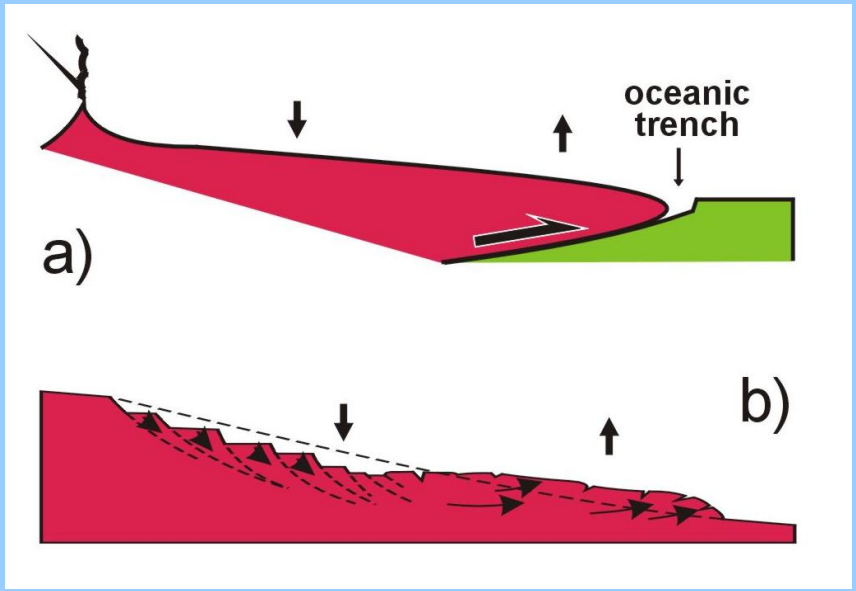


Valdivia
1960

The whole area between the line of volcanoes and the Chilean trench was stretched towards the trench.

Now, let us pass to the vertical displacements:

Vertical displacements



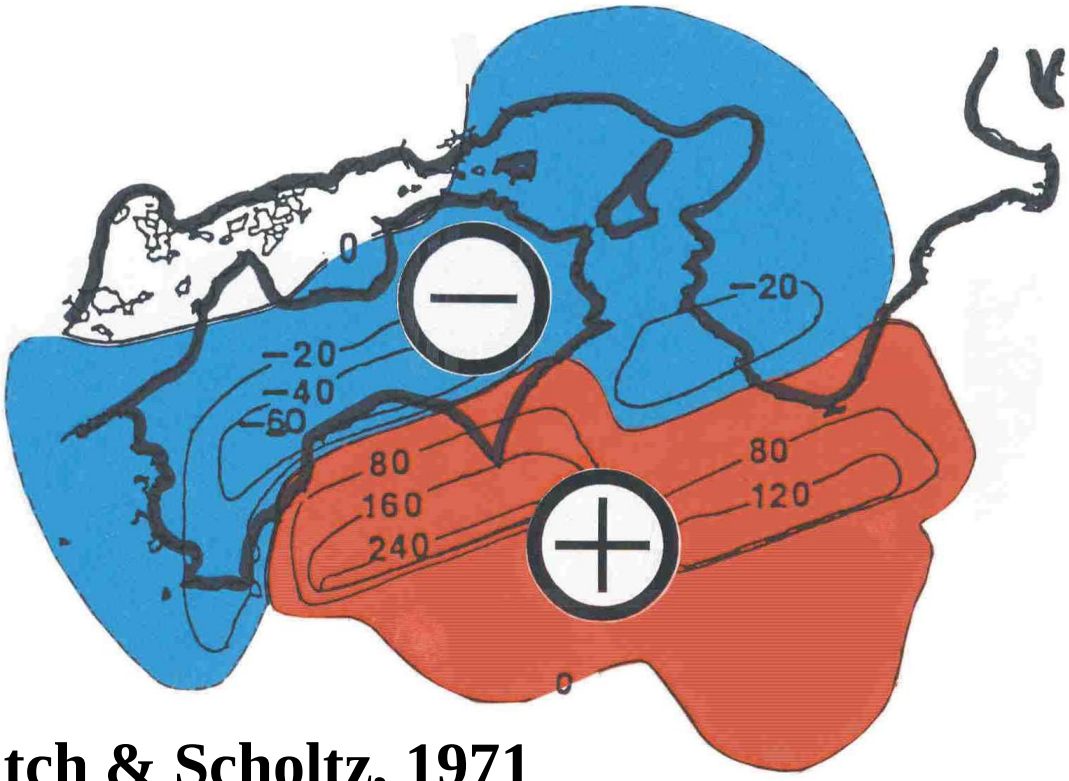
They are as we see in this figure (a) and they are exactly like in landslides (b).

The frontal part of landslide is uplifted and the back part is lowered.

Now, we will demonstrate the landslide patterns of vertical displacements on the examples of former earthquakes.

The Nankaido earthquake:

Nankaido 1946

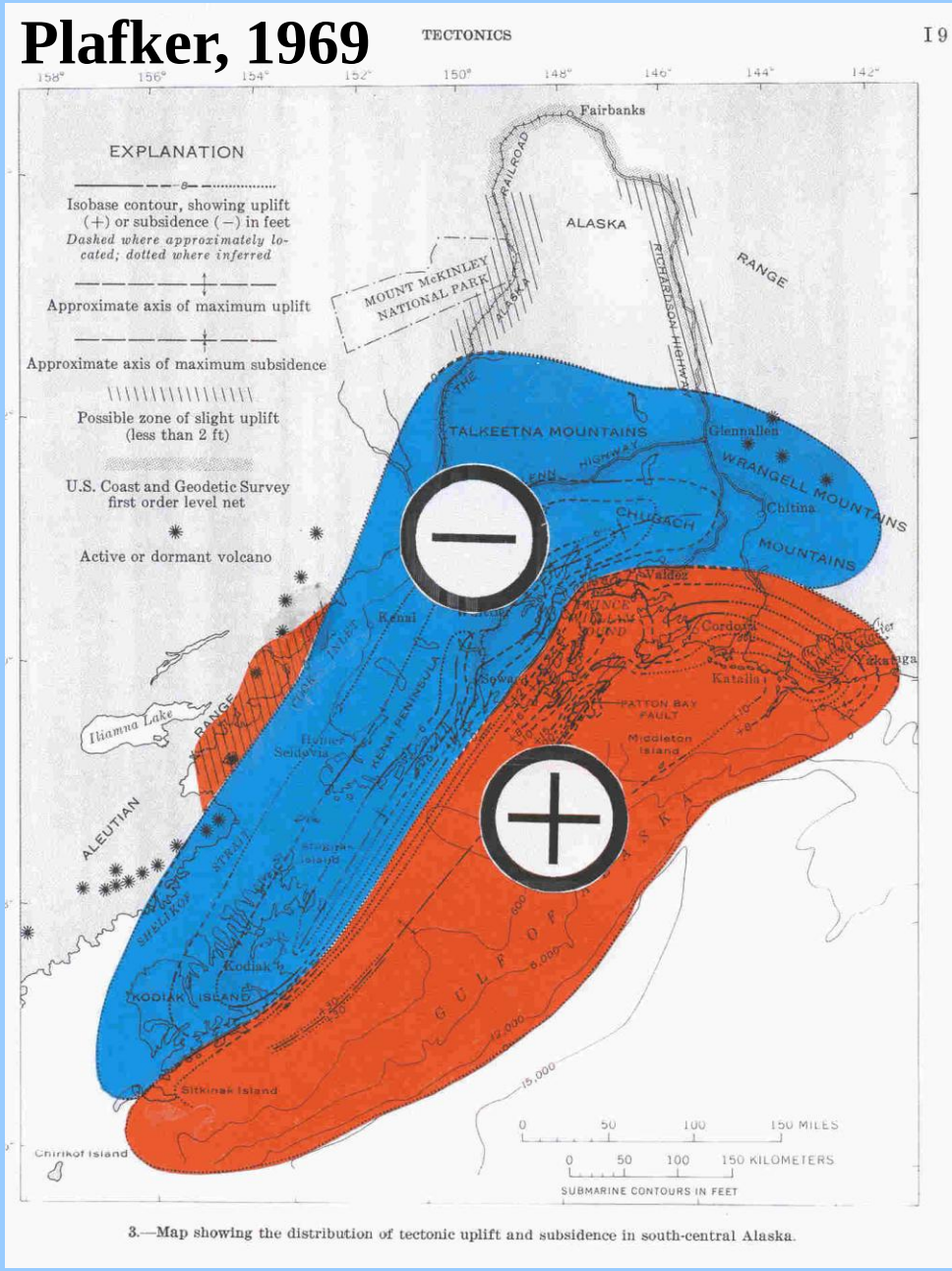


Fitch & Scholtz, 1971

The frontal part near the Japanese trench was uplifted and the back part, near the volcanic line, was lowered.

The Alaskan earthquake:

Plafker, 1969



3.—Map showing the distribution of tectonic uplift and subsidence in south-central Alaska.

Anchorage 1964

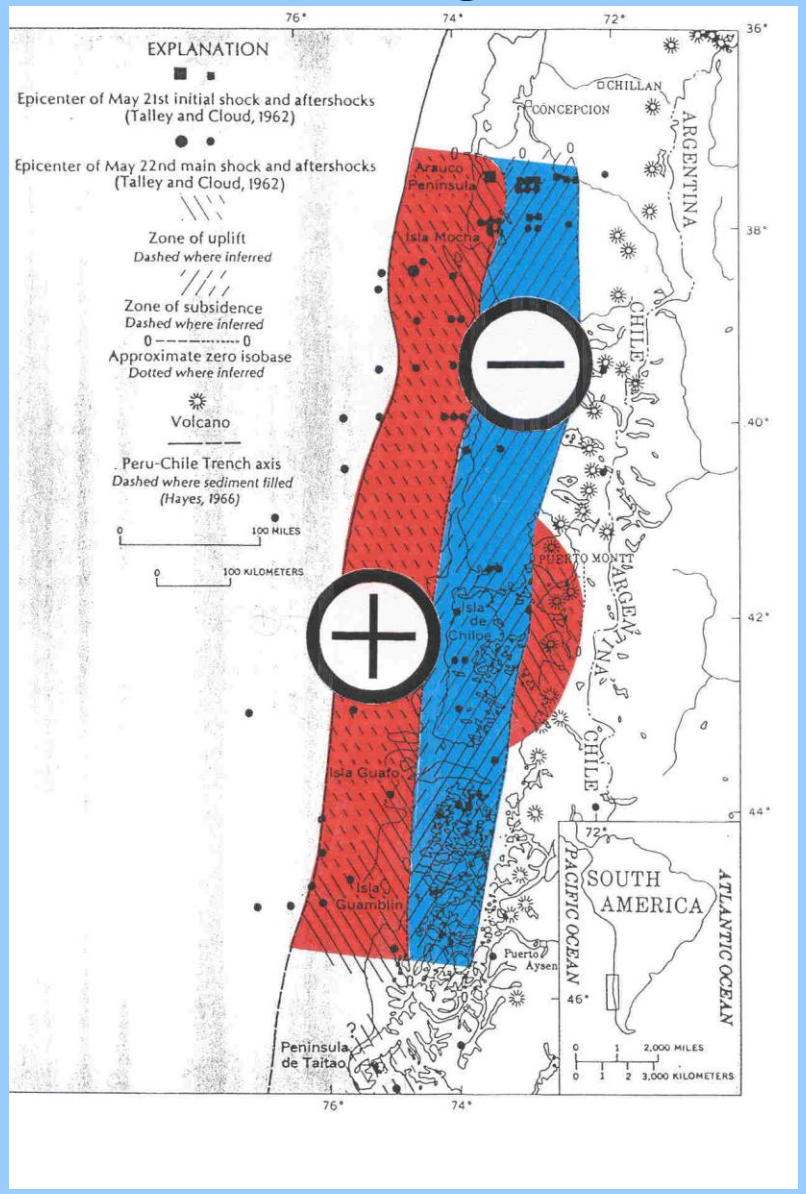
The whole back part, near the volcanic line, was lowered and the frontal part, near the Aleutian trench, was uplifted.

On the volcanic line the uplifting also occurs due to tectonic gravitational erosion (translation of rock masses toward oceanic trench) triggering decompression of volcanic chambers.

In this picture we see the uplifted bottom of the oceanic shelf in Alaska.

The Chilean earthquake:

Plafker & Savage, 1970

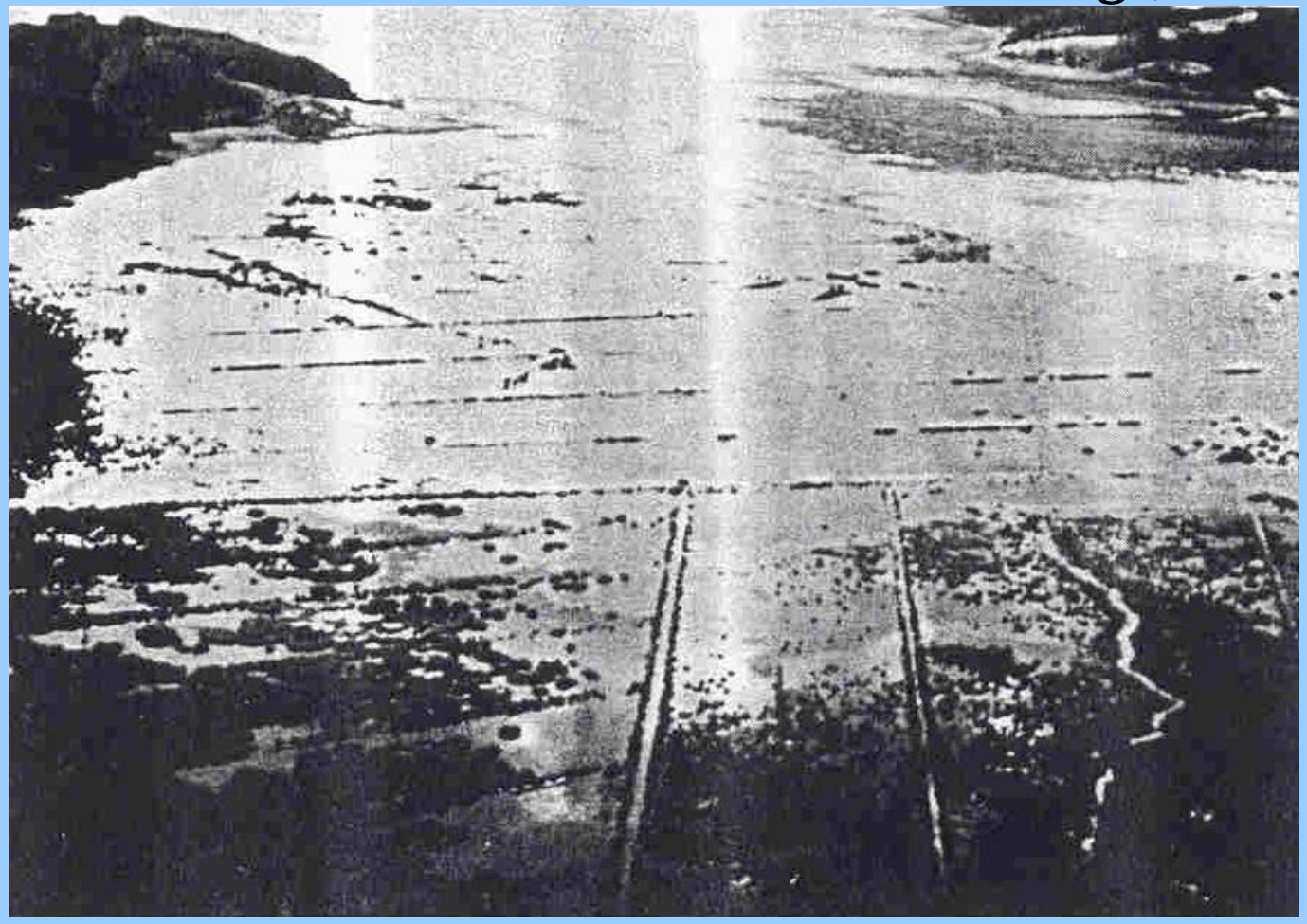


Valdivia 1960

The whole frontal part, near the Chilean trench, was uplifted and the back part, near the volcanic line, was lowered.

At the volcanic line the uplifting also occurs due to tectonic gravitational erosion triggering decompression.

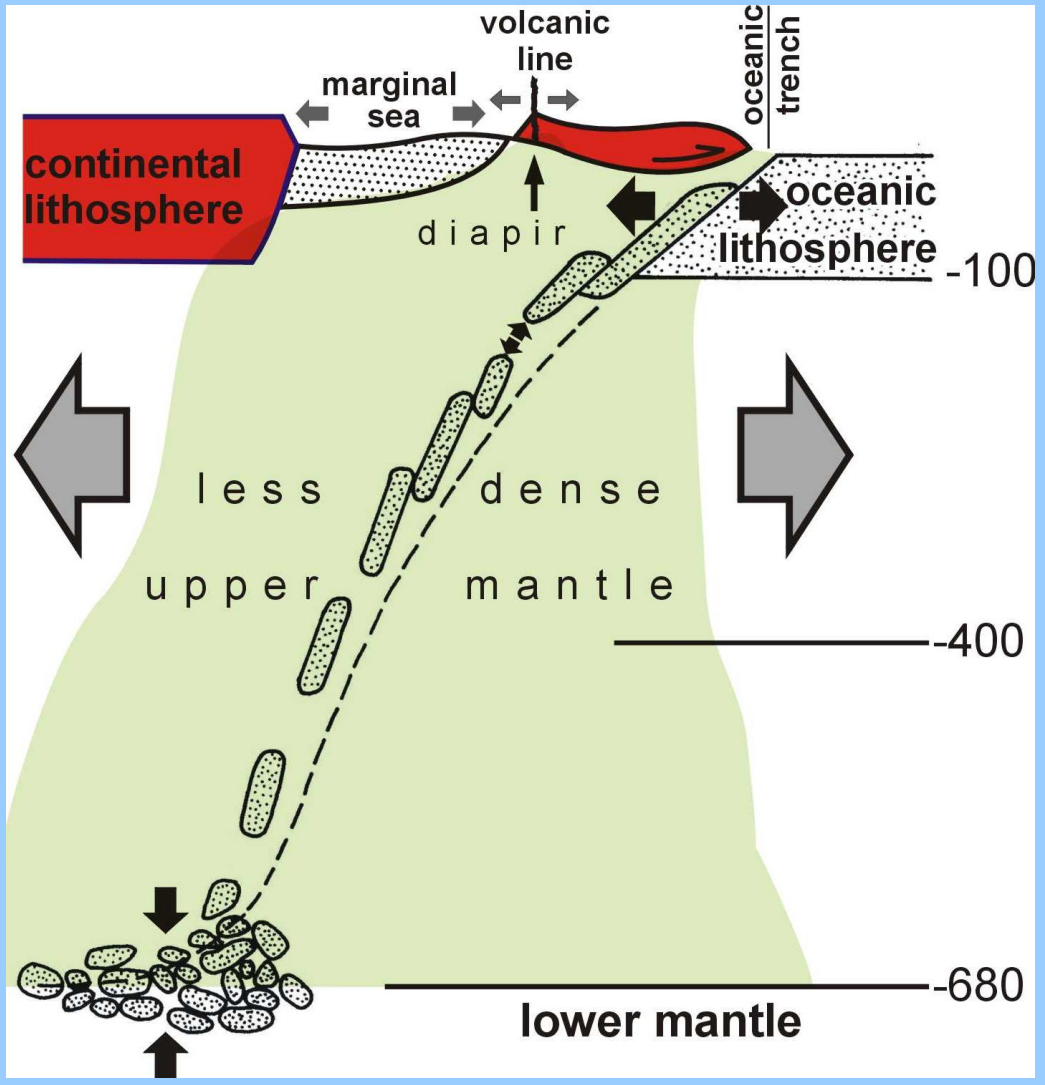
Plafker & Savage, 1970

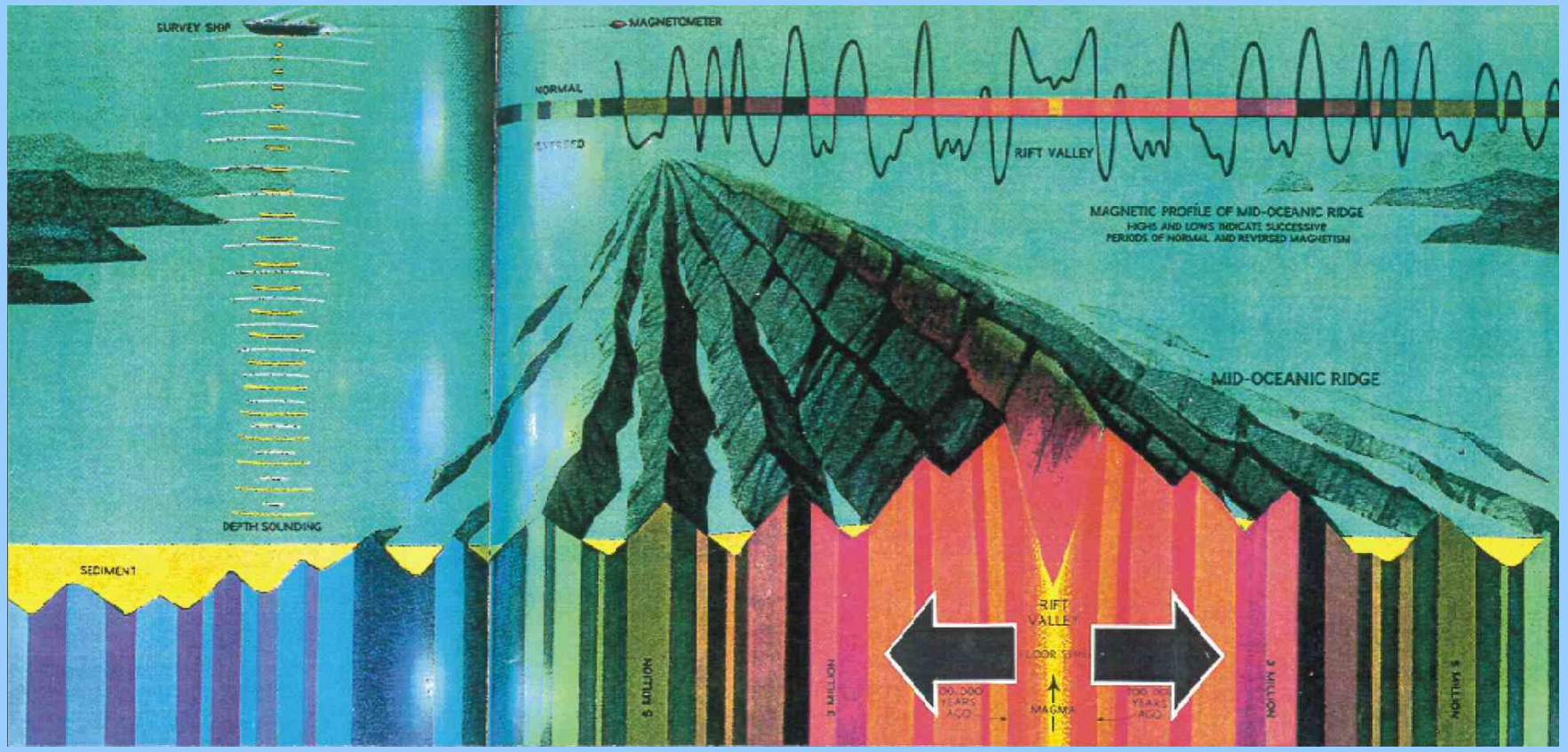


In this picture we see lowered land in Chile flooded by the ocean water.

And so we have proved the whole tension – gravitational scheme of the active continental margins.

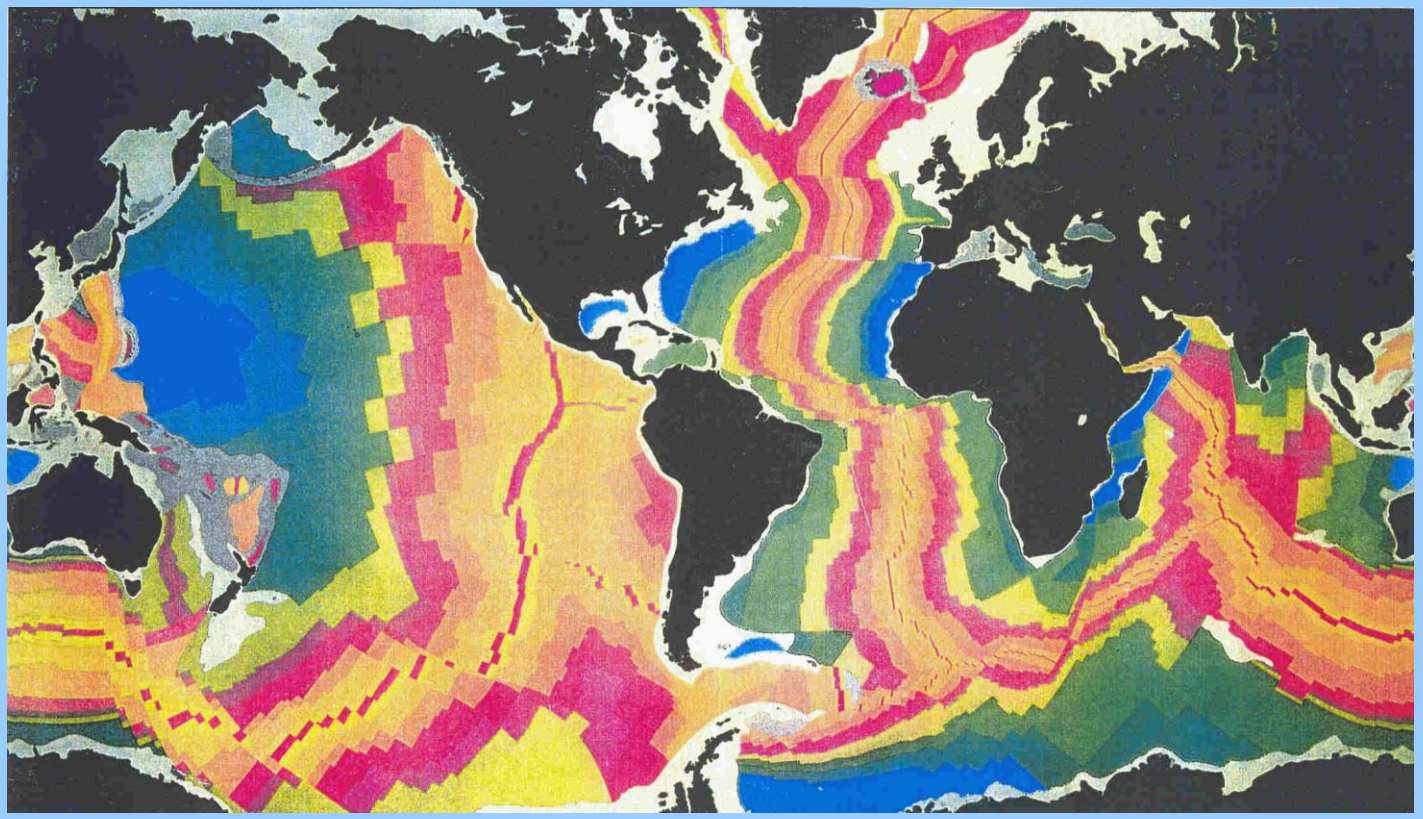
And only now we are authorized to come to a global statement and it will be a **conclusion** not an assumption.





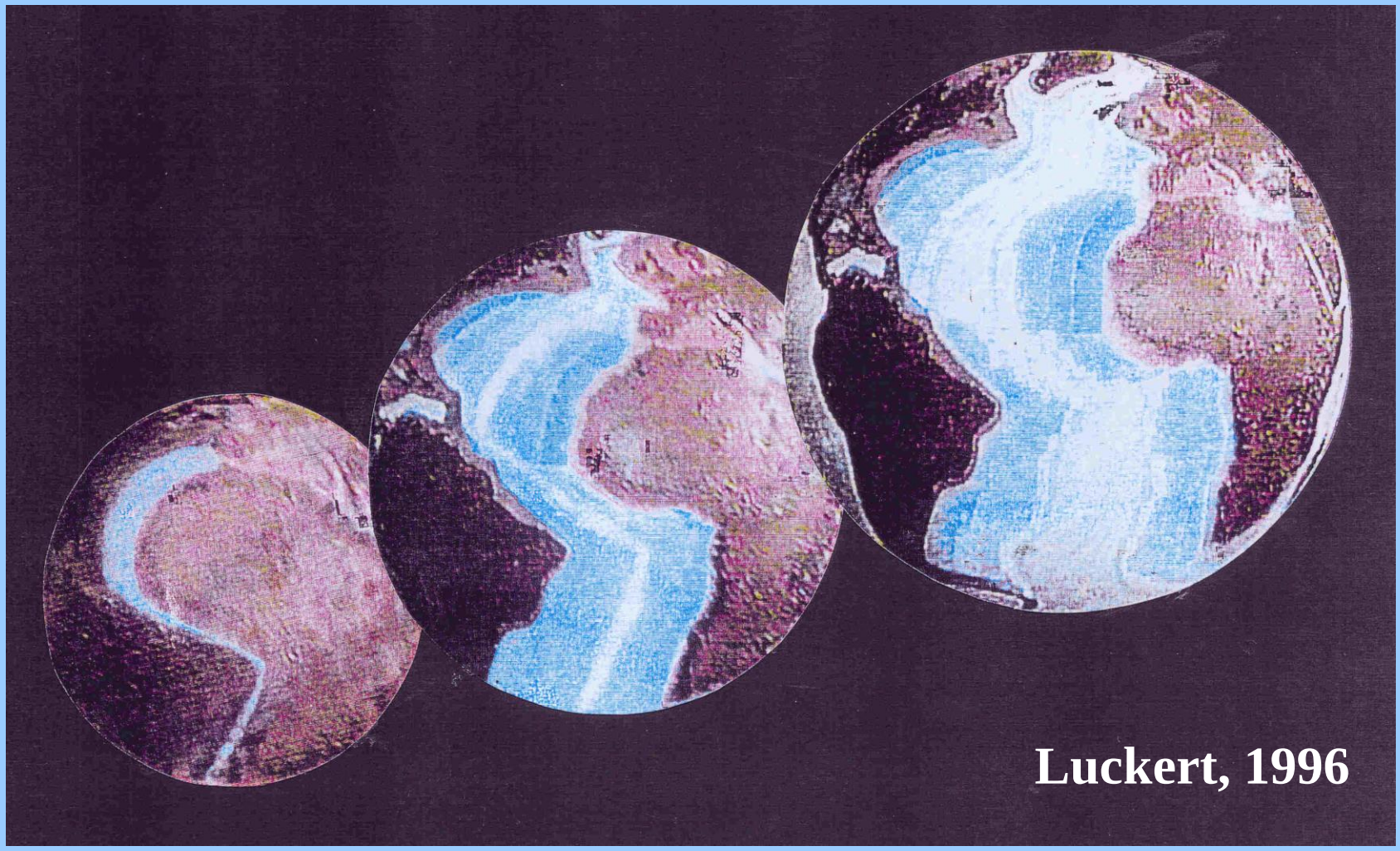
At the oceanic ridges a huge process of spreading of the oceanic lithosphere occurs.

This process has created the whole oceanic lithosphere in the past 150 million years:

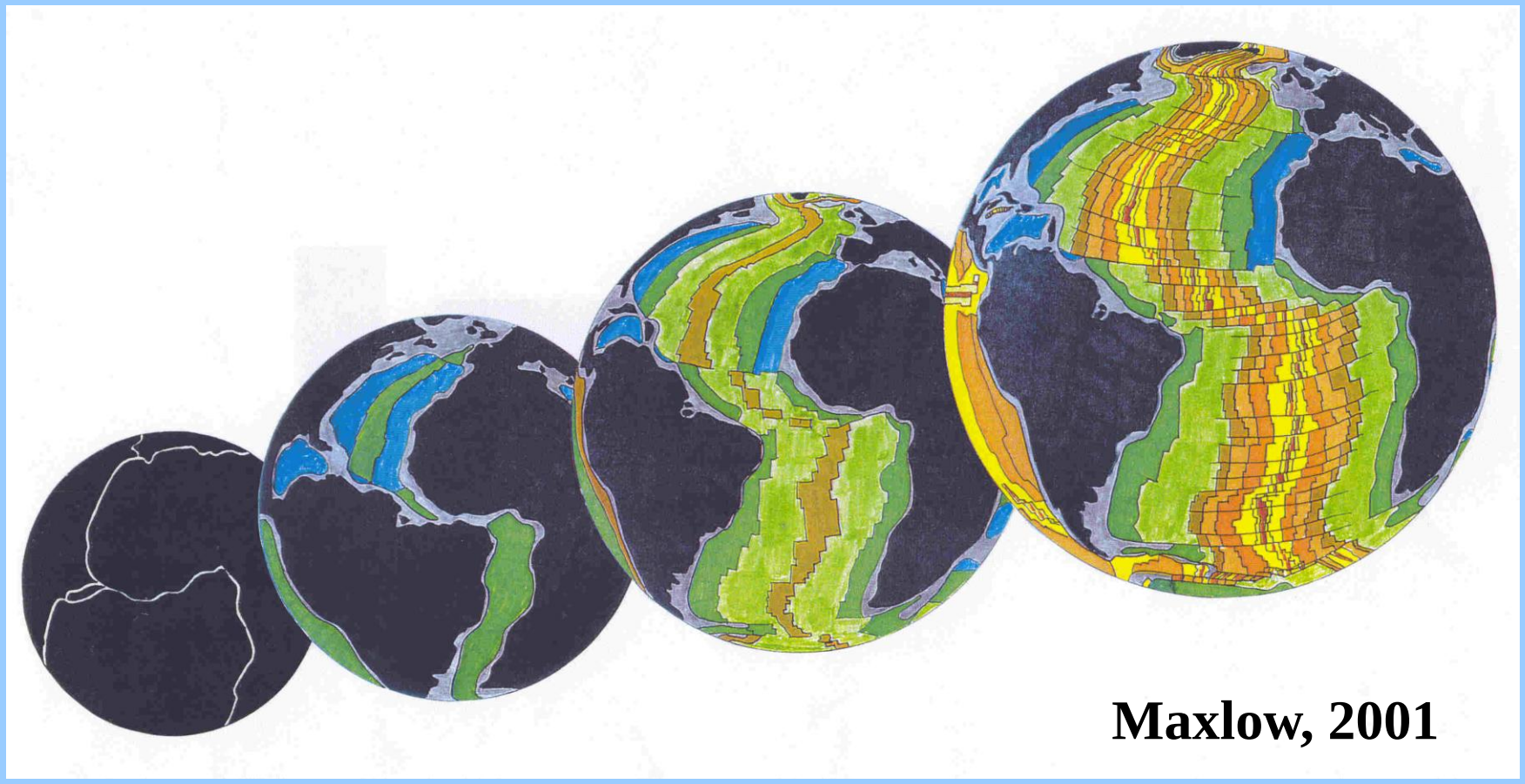


However, this process has not been compensated in the active continental margins, so the Earth is expanding....

... As we can see it on the reconstructions by Klaus Vogel,



by Karl Luckert



and by James Maxlow.

Thank you for your attention

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