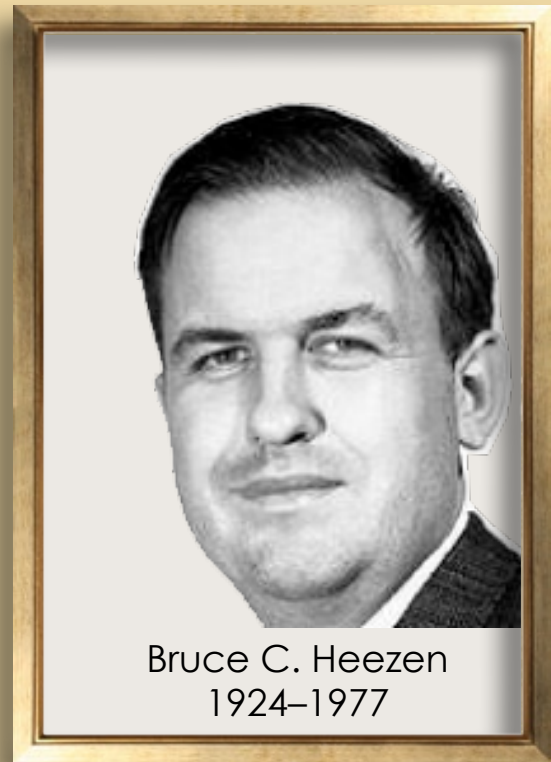
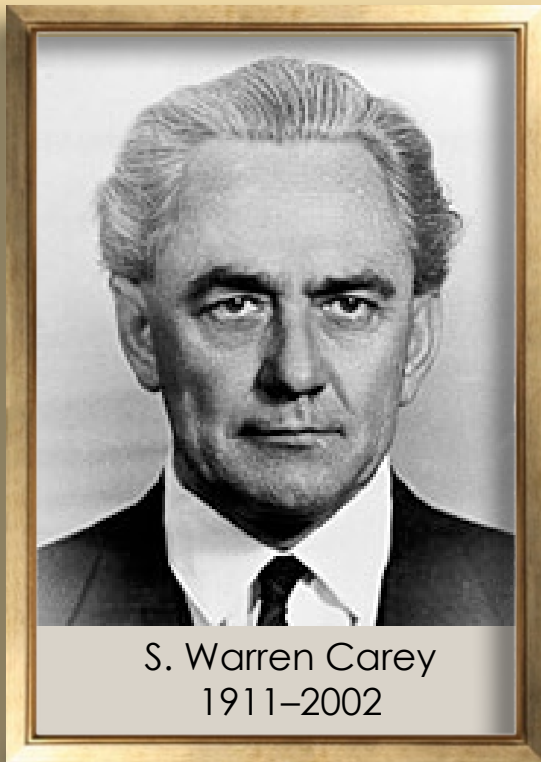


JAN KOZIAR

Priority of expansionists in the discovery of the sea-floor spreading



Berlin 1996
Digital edition Wrocław 2014



Introduction (2014)

Spreading of the ocean floor is the most important geologic process responsible for creation of about three quarters of the Earth's lithosphere. Its discovery is almost recent and has revolutionized Earth sciences.

Before the discovery geologists had returned to pre-Wegener concepts and mostly believed that oceanic lithosphere is old, much older than the continental one¹. After the discovery it appeared that the oceanic lithosphere is very young, much younger than the continental one.

Before the discovery a key to understanding of the fundamentals of global geology was the geology of lands which is very complex and comprises only about one third of the Earth's lithosphere.

After the discovery a key to understanding of global geology became geology of oceans which appeared to be simple and comprises the majority of the Earth's lithosphere.

However over the years some serious controversies arose about the spreading of the ocean floor. They concern fragments of continental lithosphere dispersed within the oceans and the old age of suboceanic mantle, which is locally intruded in a solid state into young oceanic lithosphere. The controversies concern also the subcontinental characteristics of the suboceanic mantle. These problems are so important that a number of scientists² decided to reject the spreading of the ocean floor and return to fixism (stable position of continents), developing alternative solutions³.

It has become clear that the key to understanding the fundamentals of geological processes is correct understanding the spreading of the ocean floor.

The problem is that the spreading can be considered on a non-expanding Earth, as plate tectonics does, or on an expanding Earth as it was done at the moment of the discovery of the growth of oceanic lithosphere at oceanic ridges.

It is clear that the spreading on a non-expanding Earth cannot be the same as the spreading on an expanding Earth. Spreading on an expanding Earth easily explains the dispersed fragments of continental lithosphere within the oceans (see Koziar, 1985⁴).

¹ This was according to James D. Dana's idea of growing of continents on the primordial oceanic lithosphere.

² They are gathered around the New Concepts in Global Tectonics Journal.

³ These are so-called "surge tectonics" and "wrench tectonics".

⁴ www.wrocgeolab.pl/oceans.pdf

It also explains the old age and subcontinental character of suboceanic mantle because before Meso-Cenozoic the whole mantle was subcontinental and old. The ancestors of today's continents completely enveloped the Earth in earlier times. The old mantle has got below present young oceanic lithosphere through simple pulling out from below continents (see Koziar, 1985-quoted, 1994⁵ and 2012⁶). The pulling out happened without any convection currents. The pulled-out subcontinental mantle material can be locally emplaced in the young oceanic lithosphere in a solid (plastic) state (again without any convection currents), preserving its old isotopic age and subcontinental isotopic signature. Such plastic (cold) emplacements (protrusions) of slices of mantle rocks at mid-oceanic ridges and their solid state magnetization were foreseen by Carey (1976, p. 12) as the result of expansion of the Earth. Both processes are now widely recognized at slow- and ultra-slow-spreading centres and also at transform faults at so-called transverse ridges.

Unfortunately the expanding Earth solution was almost completely swept out from text-books and minds of geologists and laymen. It is necessary to remember that spreading of the ocean floor (and also the existence of lithospheric plates) were discovered by expansionists: Samuel Warren Carey (1958) and Bruce C. Heezen (1959, 1960). Both authors treated the spreading as a manifestation of a large expansion of the Earth.

Carey was a man who influenced postwar America in the direction of mobilism⁷. Heezen was a main author of the first precise physiographic maps of the ocean floors, presented below in chronological order.



Heezen et al., 1967



Heezen et al., 1968

⁵ www.wrocgeolab.pl/plates.pdf

⁶ www.wrocgeolab.pl/geodesy1.pdf

⁷ See www.wrocgeolab.pl/lectures.pdf (Introduction)



Heezen et al., 1969



Heezen et al., 1971

The second author, who transformed Heezen's bathymetric data into physiographic diagrams, was Marie Tharp⁸. She was a real discoverer of rift fissure on the Mid-Atlantic ridge in 1952 (Tharp and Frankel, 1986).



Maria Tharp (1920-2006)



with Bruce C. Heezen



and at work

⁸ The third author was an Austrian landscape panoramist Heinrich Berann not involved in geologic matter.

Heezen and Tharp discovered the global continuous system of oceanic ridges – the “backbone of the Earth”. This biggest mountain system on the Earth appeared to be tensional.

Tharp shared Heezen’s geotectonic ideas. As Cathy Barton (2002) wrote: “Heezen and Tharp were not directly involved in the plate tectonics revolution, but favoured expanding-Earth theory” (p. 215).

Today very few people know that the authors of revolutionary and widely known maps and discoverers of the global system of oceanic ridges were expansionists⁹.

The reminder of Carey and Heezen as real discoverers of spreading of the ocean floor is important not only to honour them. There is a fundamental difference in scientific approach to the basic scientific problems between Carey and Heezen on the one hand and the first founding fathers of plate tectonics, Robert S. Dietz and Harry H. Hess on the other. Carey and Heezen applied empirical methods analyzing observational facts which lead to conclusion of Earth expansion. These are: expansion of the Pacific¹⁰, inflated ridges around Africa and Antarctica¹¹ and opening of rifts at opposite sides of continents¹².

Hess was the author of a paper (Hess, 1962) which directed almost all 1960s’ mobilists towards the plate tectonics and he operated in an opposite way. Hess himself called his paper “geopoetry”. He started from the hypothesis of the primordial state of the Earth then from hypothesis of convection currents and of course from non-expanding-Earth-assumption. The other founding father, Robert S. Dietz (1961), started similarly from the convection currents hypothesis and non-expanding-Earth-assumption. He himself called his approach “intuitive”. Both these authors rejected the expanding Earth but their arguments can be hardly accepted as scientific. For Dietz his solution “*is less radical*” than the expanding Earth and for Hess “*there is no apparent mechanism within the Earth to cause*” expansion. Hess’ attitude is especially striking because he himself acknowledged that the expanding Earth removes three of his “*most serious difficulties*” that is “*the present apparent deficiency of sediments, volcanoes and old mid-ocean ridges*”¹³. After all these are observational facts.

Dietz and Hess did not oppose to arguments presented by Carey and Heezen but ignored them.

The attitude of the second generation of fathers of plate tectonics from the end 1960s was similar. Dan McKenzie (1969, p. 1) brushed off the expanding Earth by his statement that such big and young expansion is “*unreasonable*”. This cannot be accepted as a scientific argument. Jason Morgan did not mention the expanding Earth at all. Xavier Le Pichon (1968, p. 3674) started from a non-expanding Earth assumption:

⁹ After years, under pressure of plate tectonics Heezen retreated from expanding Earth.

¹⁰ See Koziar 1993; www.wrocgeolab.pl/Pacific.pdf

¹¹ See Koziar 1980; www.wrocgeolab.pl/floor.pdf

¹² Later Carey delivered other proofs of the expansion of the Earth.

¹³ See quotations in the main text.

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.

He indeed tried to prove this assumption but in fact he only confirmed the expansion of the Earth (Koziar, 1985¹⁴, 1991 and 2014¹⁵).

Similarly to Dietz and Hess the second generation of fathers of plate tectonics did not oppose to arguments presented by Carey and Heezen but ignored them.

But only after settling what is happening to the Earth in an observational way we can investigate successfully what is going on inside of our planet and how it originated. This is the method applied by the real discoverers of the process of the spreading of the ocean floor.

The problem of the priority in the discovery of the spreading and differences in scientific approach can be demonstrated, using slides from my lecture presented on 14 November 1996 in Berlin at the Technical University on the invitation of Professor Karl-Heinz Jacob. The lecture was entitled “*Ways and wrong ways in geotectonics*”. The presented set of slides was only a part of this wider topic. The same lecture was presented earlier at my parent Institute of Geological Sciences of the Wrocław University on 28 March in Polish. Then the report was published (Koziar, 1996) also in Polish but without slides concerning priority of the discovery of the spreading.

The presented now slides comprise quotations and figures from papers by Carey, Heezen, Dietz and Hess supported by my short comments. The final part of the set is here slightly modified.

*J. Koziar
December 2014*

Acknowledgement:

I would like to thank Professor Cliff Ollier for improving the English of the introduction and my texts on the slides.

¹⁴ www.wrocgeolab.pl/oceans.pdf

¹⁵ www.wrocgeolab.pl/circle.pdf section 20a – “The Le Pichon expanding great circle”.

Slides from the lecture
"WAYS AND WRONG WAYS IN GEOTECTONICS"
delivered on November 14, 1996
at the Technical University in Berlin

**The first who published
the ocean-floor spreading hypothesis
was Samuel Warren Carey
(in 1958)**

S. Warren Carey 1958

The Mid-Ocean Ridges

I. Spreading

The rift mechanism produces identical morphology irrespective of whether it occurs in continental crust or across ocean floors. (...) (p. 187)

These mid-oceanic ridges with their narrow central troughs and earthquake epicentres are the present positions of the mid-rift dilatation zones which commenced when the continental coasts first parted some two to three hundred million years ago. (p. 312)

*"The tectonic approach to continental drift"
Continental Drift A Symposium
Tasmania, Hobart 1958*

**But Carey noticed more
than the later founders
of the plate tectonics hypothesis**

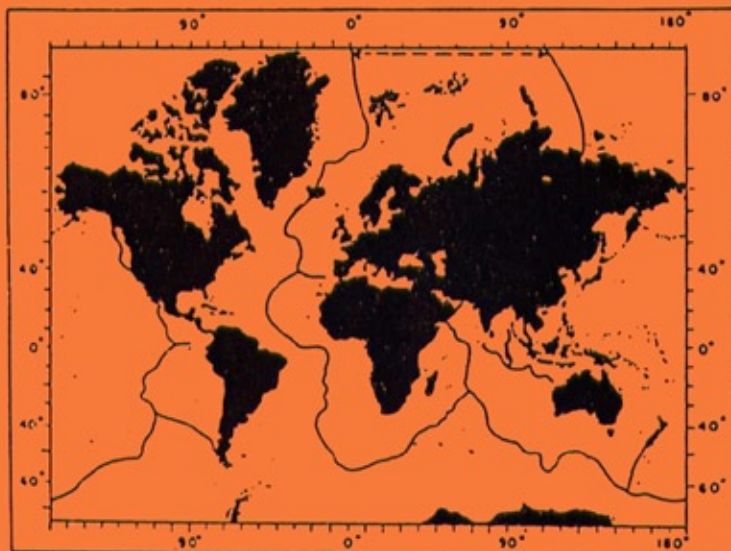
S. Warren Carey 1958

The Mid-Ocean Ridges

II. Spreading, and what more?

a). *Bloating of the rifts*

I have referred to the mid-oceanic rift zones which divide the Atlantic and Indian Oceans, and I have pointed out (Fig. 4b) how the pattern of these rifts caricature the shapes of the kernel continents enclosed within them. On a globe the governing shape of Africa, and of South America and of Australia is strikingly clear in these ridge patterns. But there is never a facsimile. It is bloated, inflated towards a more circular shape (see "ghost" of Africa in Fig. 4b). (p. 312).



The mid-oceanic crack system (after Ewing)

*"The tectonic approach
to continental drift"
Continental Drift
A Symposium
Tasmania, Hobart 1958*

S. Warren Carey 1958

The Mid-Ocean Ridges

II. Spreading, and what more?

b). The same features in the Pacific

The point of immediate relevance is that these characteristic [of the rifts] are not confined to the more generally accepted rift oceans (the Atlantic, Arctic and Indian Oceans) but are also shared by the Pacific. The Pacific also possesses median ridges, roughly equidistant from the coasts they caricature, and which are loci of seismicity. If I am to be consisted the Pacific must also be interpreted as an immense dilatational rift.

(p. 312-13)

"The tectonic approach to continental drift"

Continental Drift A Symposium

Tasmania, Hobart 1958

**The first who noticed
that the Earth-shell
is divided into lithospheric plates
was also S. Warren Carey**

S. Warren Carey 1958

Polygons (plates)

I. Existence

Plotted on a globe the median oceanic ridges form a crudely polygonal pattern dividing up the globe into dilatation segments...

(p. 313)

*"The tectonic approach to continental drift"
Continental Drift A Symposium
Tasmania, Hobart 1958*

**But Carey noticed more
than the later founders
of the plate tectonics hypothesis**

S. Warren Carey 1958

Polygons (plates)

II. Universal dispersion of the plates

On each of the maps I have presented it will be found that every block has increased its distance from all its neighbours. (...) This kind of relation is general. Wherever I may start I find that all neighbouring blocks have dispersed. (...) This universal dispersion implies an expanding earth... (p. 313 & 316)

"The tectonic approach to continental drift"
Continental Drift A Symposium
Tasmania, Hobart 1958

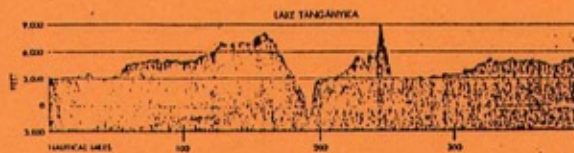
Bruce C. Heezen

**was the next one who published
the ocean-floor spreading hypothesis
and combined it
with the expansion of the Earth
(in 1960)**

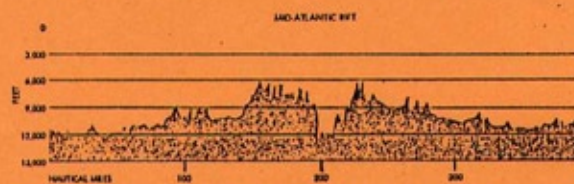
Bruce C. Heezen 1960

I. Spreading

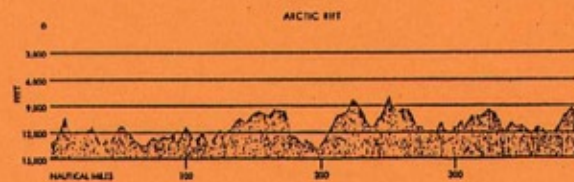
A typical cross section of the mid-ocean rift and ridge has a profile that is strikingly similar to that of the African rift. (p. 102)



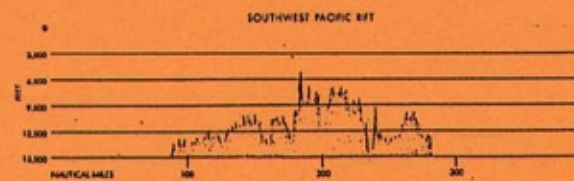
Lake Tanganyika



Mid-Atlantic Rift



Arctic Rift



Southwest Pacific Rift

WIDELY SEPARATED PROFILES show similarity of ridge and rift throughout the world. An up a profile across African Rift, Hawaiian, and Lake Tanganyika within rift. The Arctic rift is a few hundred miles west of North Pole by the Antarctic Peninsula on voyage under the polar ice. The entire profile was furnished by Robert S. Dietz of the Percy Foreman Laboratory in San Diego. In each of these profiles the rift is approximately above the 100-mile mark. Color denotes water.

"The Rift in the Ocean Floor"
Scientific American,
Vol. 203 no 4, p. 99-110

Bruce C. Heezen 1960

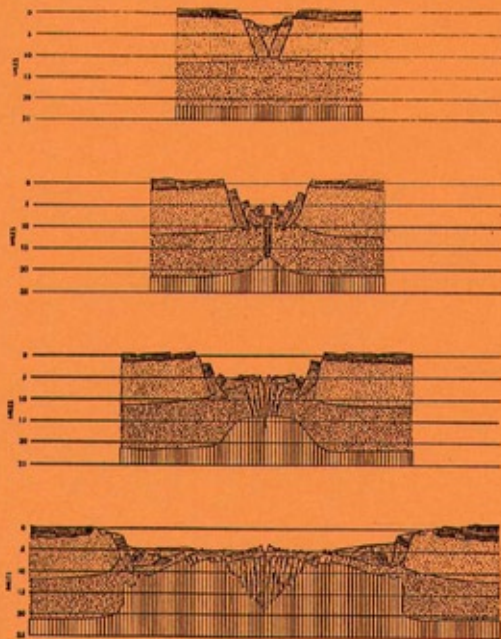
II. Spreading and expanding earth

The drift theory would argue that an immense section of the earth's crust, from the rift valey in one ocean to the rift valley in the next ocean, must be moving as a body. But the movement would be opening up the rift on the trailing edge of the body and closing the rift at its leading edge. There is no evidence for such a reciprocal action. On the contrary, the rift seems to be opening up on all sides of every continent.

In an attempt to overcome this dilemma I have recently suggested that the earth is neither shrinking nor remaining at the same size; rather, it is expanding. If the

earth were expanding and the continents remained the same size, additional crust would have to be formed in the oceans. This is apparently just what is happening in the mid-ocean rift valleys.

(p. 108)



EVOLUTION OF OCEAN BOTTOM according to the spreading with hypothesis is represented by these diagrams. The type of material is sedimentary rock of sandstone. Below is a cross-section of the rift valley in the type of material that makes up the area of the ocean. Bottom layer (unconformity) is the

ocean's mantle. In top diagram rift valley is shown together with rift valley in the spreading up. From material from oceanic crust through rift, creating mid-ocean ridge seen in third diagram. Bottom diagram represents Atlantic Ocean bottom, as it is today, with ridge and rift in center and continents on the sides and left.

"The Rift in the Ocean Floor"
Scientific American,
Vol. 203 no 4, p. 99-100¹⁶

¹⁶ In fact Heezen combined tensional development of oceanic ridges with the expansion of the Earth one year earlier in a short text and did it less emphatically. He wrote: "The location of the Mid-Oceanic Ridge, oft cited as a remnant of the original continental rift, opposes continental drift since it seems to require that the continents drift in several directions at the same time. A possible way out of this dilemma is to postulate an expanding earth;..." (Heezen, 1959, p. 28) – (footnote, 2014).

**At the beginning of the sixties
Robert S. Dietz and Harry H. Hess
pushed the ocean-floor spreading hypothesis
towards plate tectonics, not challenging
in a reasonable way its expanding Earth implications
pointed out by its founders
S.W. Carey and B.C. Heezen.
Dietz and Hess's plate tectonics suggestion
referred not to facts but
to a hypothetical cause of spreading
- convection currents in the Earth's mantle**

Robert S. Dietz 1961

I. Convection currents

The concept proposed here, which can be termed the "spreading sea-floor theory" is largely intuitive, having been derived through an attempt to interpret sea-floor bathymetry. (...) The assumed model is as follows:

1). Large-scale thermal convection cells, fuelled by the decay of radioactive minerals, operate in the mantle... (pp. 854 & 855)

*"Continent and ocean basin evolution
by spreading of the sea floor"
Nature, June 3 1961, Vol. 1190*

Robert S. Dietz 1961

II. The argument against expanding earth

Volumetric changes of the Earth

Geologists have traditionally recognized that compression of the continents (and they assumed of the ocean floors as well) was the principal tectonic problem. It was supposed that the Earth was cooling and shrinking.

But recently, geologists have been impressed by tensional structures, especially on the ocean floor.

To account for sea floor rifting, Heezen, for example, has advocated an expanding Earth, a doubling of the diameter. Carey's tectonic analysis has resulted in the need for a twenty-fold increase in volume of the Earth.

Spreading of the sea floor offers the less-radical answer that the Earth's volume has remained constant. (p. 856)

*"Continent and ocean basin evolution
by spreading of the sea Floor"
Nature, June 3 1961, Vol 190.*

Harry H. Hess 1962

I. Convection currents

Mid-ocean ridges have high heat flow, and many of them have median rifts and show lower seismic velocities than do the common oceanic areas. They are interpreted as representing the rising limb of mantle convection cells. /.../

Ocean ridges are ephemeral features as are the convection cells that produce them.
(p. 599)

"History of ocean basins"
in: *Petrologic Studies*,
A.E.J. Engel et al. (eds)
Geol. Soc. Am., p. 599-620

Harry H. Hess 1962

II. The argument against expanding earth

Both Heezen and Carey require an expansion of the Earth since late Paleozoic time (...) such that the surface area has doubled. Both postulate that this expansion is largely confined to the ocean floor rather than to the continents (...)

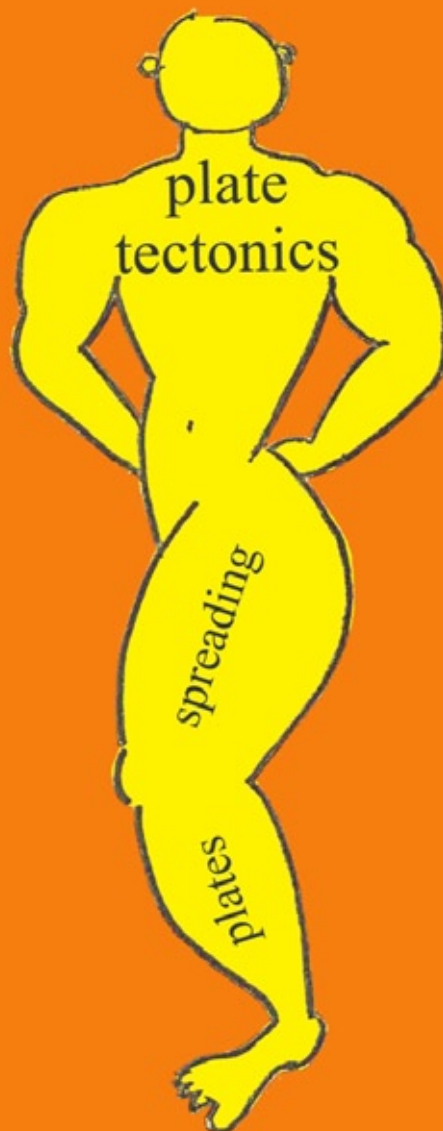
With this greatly expanded ocean floor one could account for the present apparent deficiency of sediments, volcanoes, and old mid-ocean ridges upon it. While this would remove three of my most serious difficulties in dealing with the evolution of ocean basins, I hesitate to accept this easy way out.

First of all, it is philosophically rather unsatisfying, in much the same way as were the older hypotheses of continental drift, in that there is no apparent mechanism within the Earth to cause a sudden (and exponential according to Carey) increase in the radius of the Earth.

"History of ocean basins"
in: *Petrologic Studies*,
A. E. J. Engel et al (eds)
Geol. Soc. Am., p. 599-620

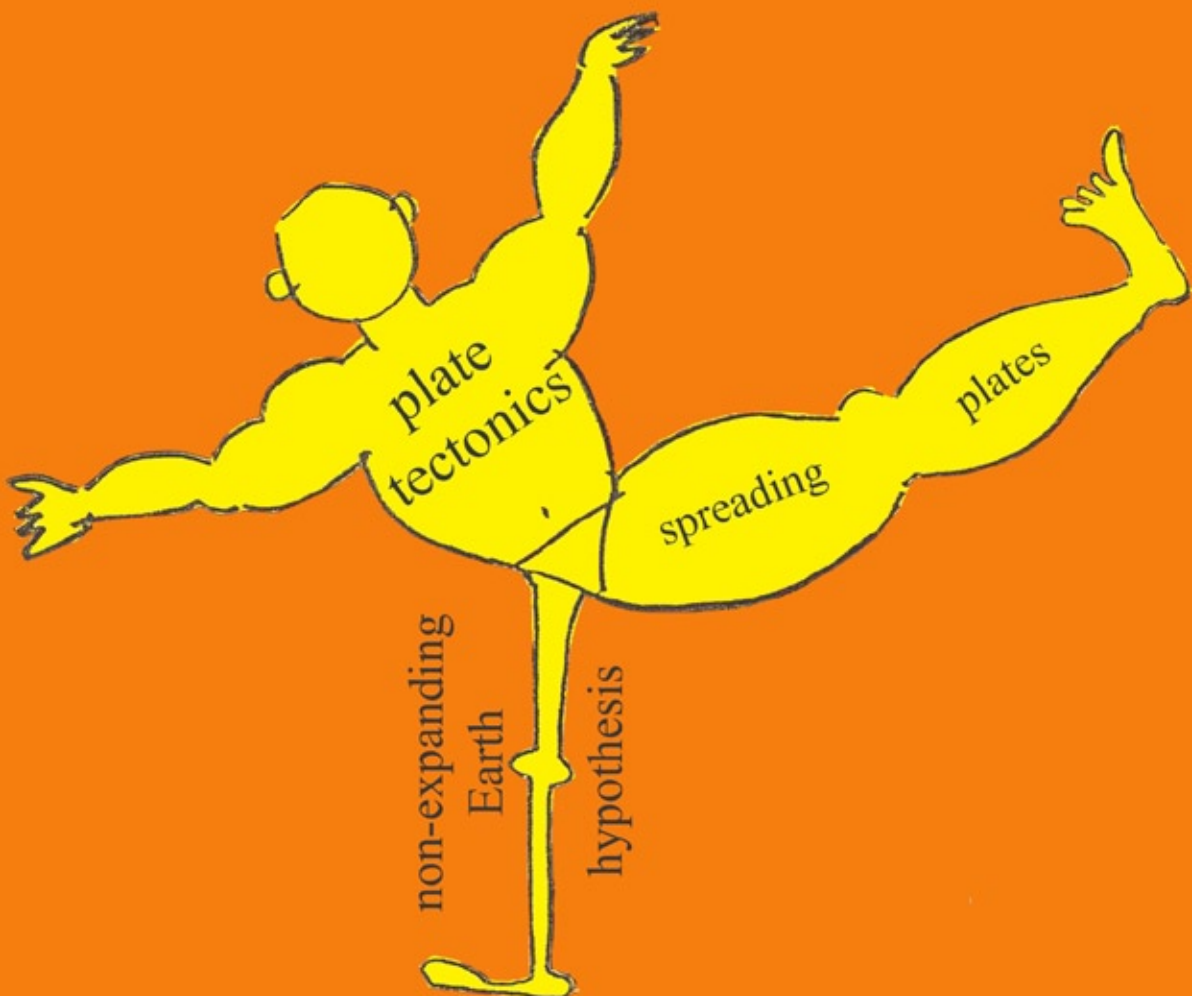
**Thus a real and specific contribution
of plate tectonics
in geotectonics is not
the spreading and lithospheric plates...**

Illusion

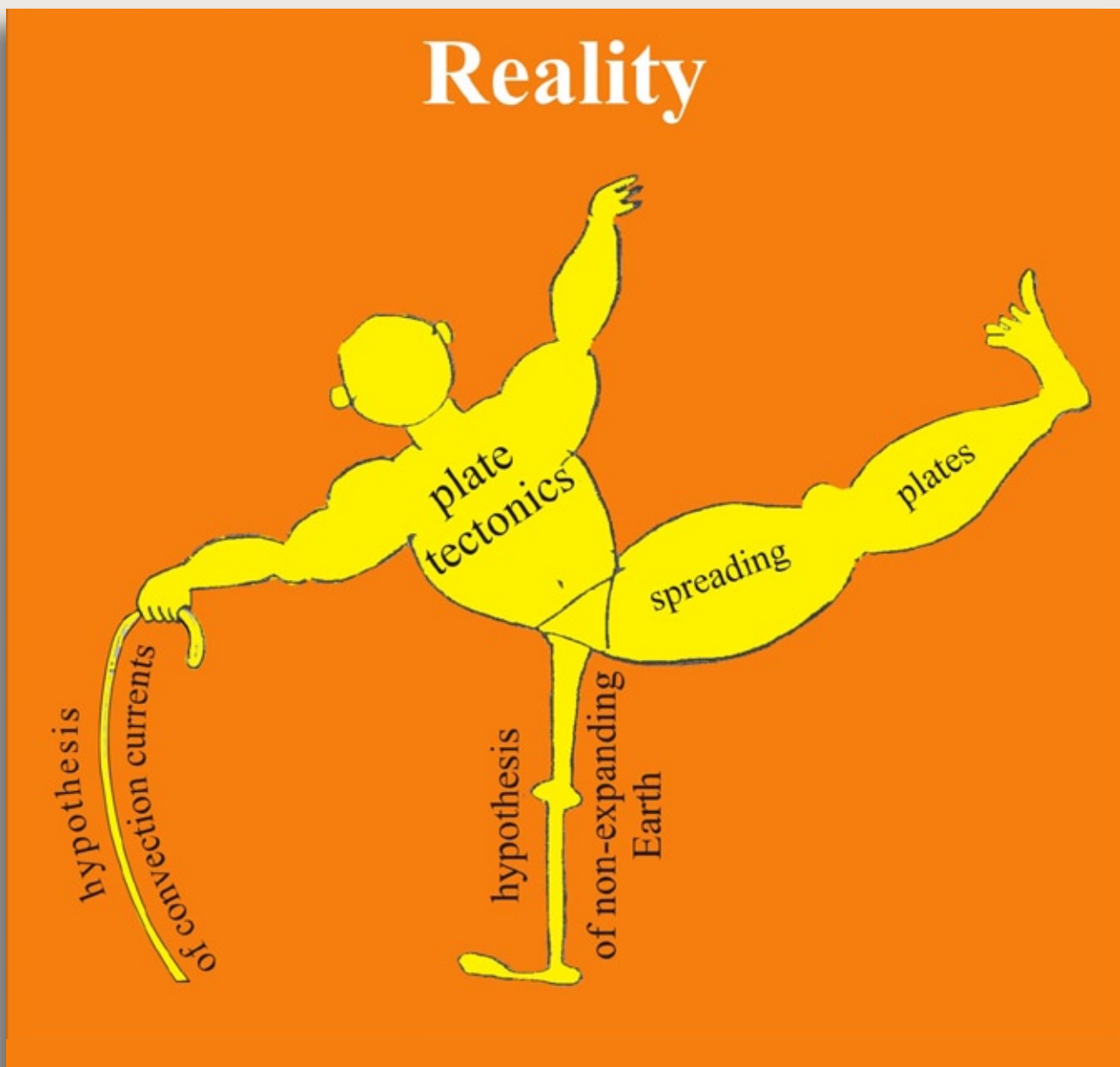


**...but an unproved
non-expanding-Earth assumption
which is its real foundation**

Reality

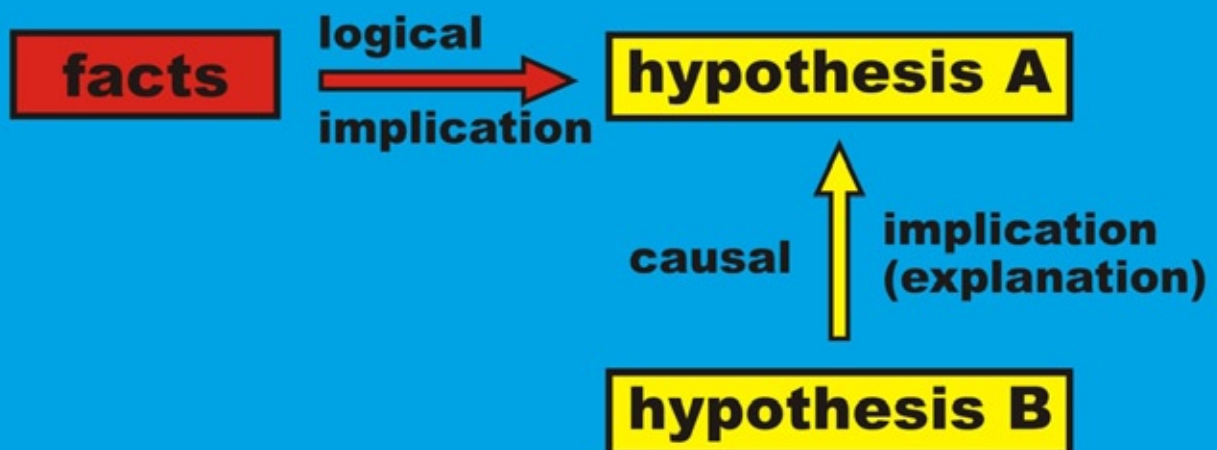


**The second pillar of the plate tectonics
is causal (physical) explanation
of its geodynamics
by the second unproved hypothesis,
that is by assumed convection currents
in the Earth's mantle**



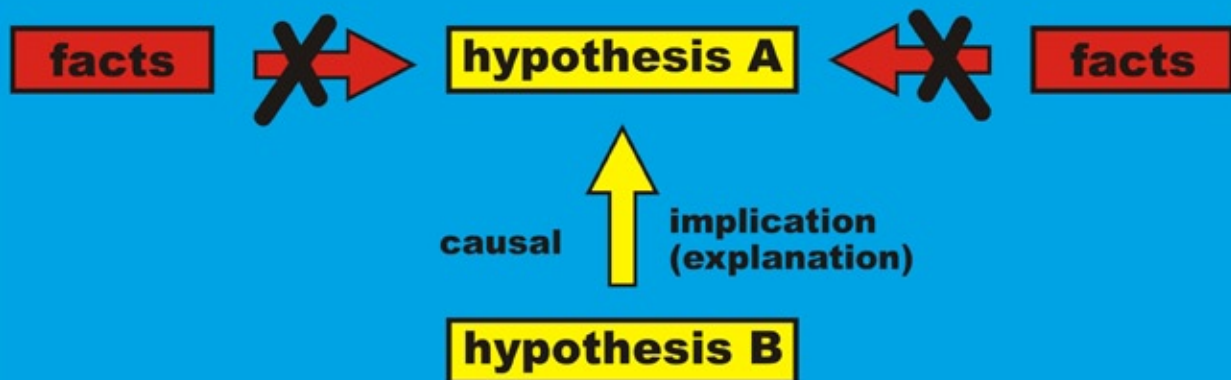
**However there is a big difference
between logical (empirical)
implication from facts
(applied by Carey and Heezen)
and causal implication
from hypothetical physical process
(applied by Dietz and Hess)**

Logical and causal implication

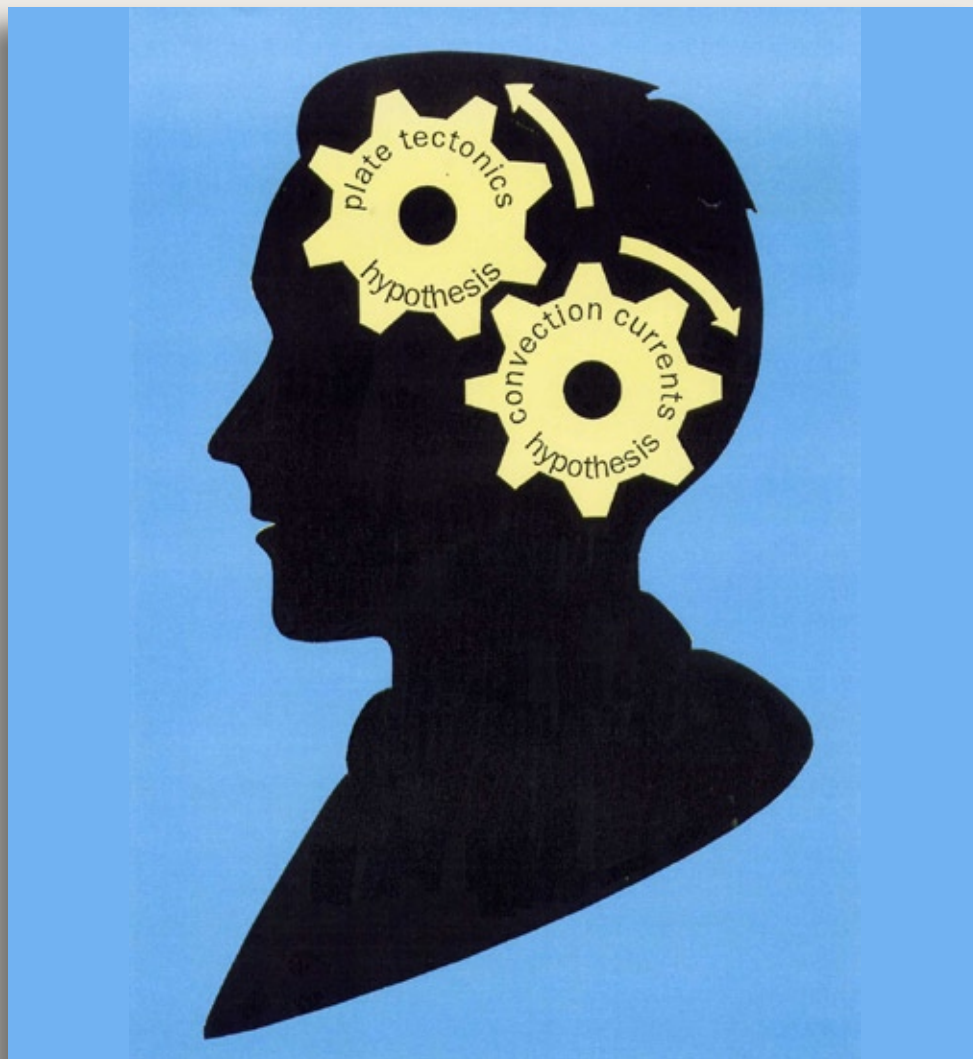


The first has fundamental significance in science while the second can lead to “proving” one hypothesis by another hypothesis

A causal explanation can be “proving” one hypothesis by another hypothesis



From the beginnings of plate tectonics it could not fit any set of convection currents with the motion of plates¹⁷. Thus in fact there are no convection currents to drive the lithospheric plates, but the hypothesis of convection currents drives the plate tectonics hypothesis in the minds of its supporters



¹⁷ Similarly the „slab-pull” and “ridge-push” hypotheses are unsuccessful. East Pacific Rise is almost flat but the spreading is here super-fast and the distance to Mariana Trench is extreme long. Mid-Atlantic Ridge is steep but at neighbouring continents there are no alleged subduction zones. (2014)

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