

Spread and Growth
Tectonics:
the Eocene Transition

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Plate Tectonics—Spread and Growth.

Expansion Tectonics.

Continents, Earthquakes, Mountain formation,

Oceans, Rifts, Trenches.

From the Jurassic through the Eocene

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Preface and Perspective

*Rifts tore Continents—made room for Ocean Floor to SPREAD.
Continental shores GREW Ocean Floor to heal the Rift between them.
Ocean Floors will spread where Continents are touching, where Earth
encrusts her grainy Passion, Blood, and Glow.*

Why not call it "Plate" Tectonics?

Many conflicts in science, culture and religion are consequences of misunderstandings, imprecise naming and ambiguously focused perspectives. From its inception in the 1950s and 1960s, the science of Plate Tectonics has been—as all human enterprises sooner or later are wont to be—haunted by ambiguities of its own making. Human languages cannot communicate precision with words that minds, aspirations and ambitions, cannot fully digest.

Here is what we have found, for a starter, summarized in *Encyclopedia Britannica*: "The Earth's tectonics plates theory is dealing with the dynamics of Earth's outer shell, the lithosphere... providing a uniform context for understanding mountain building processes, volcanoes, and earthquakes, as well as understanding the evolution of the Earth's surface and reconstructing its past continental and oceanic configurations.... According to the theory, Earth has a rigid outer layer, known as the lithosphere, which typically is about 100 km (60 miles) thick and overlies a plastic layer called the asthenosphere. The lithosphere is broken up into about a dozen large plates and several smaller."

We will underline the Alfred Wegener contribution of Continental Drift with a sentence from the *Merriam-Webster Dictionary*: “The lithosphere of the earth is divided into a small number of plates which float on and travel independently [*sic*] over the mantle and much of the earth's seismic activity occurs at the boundaries of these plates.”

The designation of “plates” in Plate Tectonics was intended to combine Wegener’s “*wandernde Kontinente*” with the discovery of an ocean-spreading process along mid-ocean rifts. This contrived synthesis immediately engendered a lopsided perception. The cartographers, who began depicting magnetic-reversal stripes as isochrones—similar to the method of tree-ring dating—gave us a nearly seamless, though sequentially “relative” ocean floor chronology. Scientists labored to define ocean floor plates by way of first establishing precise contours for the plate boundaries.

However, the insistence on precision that was essential for cartographers has shifted ocean floor explorations almost unnoticed toward the presence of “plates”—even where the plates of crust looked more like mud flows. Plates that had definable contours were in demand. They were sought and found. Henry W. Menard, the director of explorations in the Pacific area, had second thoughts. He suggested that mid-ocean rifts and ridges could be ephemeral features. By implication, this would render tectonic plates to be temporary phenomena as well. Menard's caution did not stop the cartographers. And this was a good thing for Earth science, where explorers subsequently hoped to rely on the maps they made. But nonetheless, Menard's concerns have not gotten answered.

The discovery of spreading rifts, and a renewed interest in Alfred Wegener's “wandering continents,” excited Earth scientists. Had more time been spent on conceptualizing empirical “plate” data, we probably would have recognized more quickly



Fig. 1. United States Geological Survey—a World Map of Tectonic Plates

the general adhesion of ocean floors to continental boundaries. We would then not have strayed one-sidedly into asking only what spreading-rifts are doing. Upon discovering "plate formation" along mid-ocean rifts, the scientific mind—for the sake of control and understanding—immediately pondered the elimination of those plates. Military paradigms of subduction and destruction still hovered over those World War II ships, which scientists were given as tools to study ocean floors.

But ocean floors are not just simply "spreads," owned by oceans. How could ocean-water own the lithosphere that supports? The mafic floors could just as well be viewed as horizontal accretions along the shorelines of the older continents. The asthenosphere, which underlies all crusts, cannot be said to favor either land or ocean crust. The upper mantle supports and sustains both types of lithosphere.

With the kind of data available to him, Alfred Wegener could not yet have known that the continents he saw moving, were actually not independent wanderers. The paradigm of "*vagabund*

continents" (this author's translation) which Wegener invoked, was basically wrong. On the other hand, had oceanographers in the 1960s taken more care to collapse Wegener's older theory to bare data, they could have extrapolated their own data better. Their new ocean floor data—the very ocean floor chronology that they constructed from isochrones—could have enabled a fresh and better beginning, without help from Alfred Wegener.

At the present moment in the evolution of Planet Earth, all continental segments of crust that belonged to the original Earth shell, are still touching at least one of their original neighboring segments. Therefore, there should be no enduring question of how these older than 200 Ma crustal pieces could have fitted on a planet poised for expansion. **Yes, the continents all have been rifting apart, and rifts have spread to become oceans.** Presentday mid-ocean rifts broke open first as narrow cracks in the lithosphere. They broke through the crusty shell and tore apart segments the size of the present continents.

Explorers, accustomed to negative thinking, who needed to focus on difficulties for submarine warfare along insufficiently known ocean floors, were under no academic pressure to look beyond the dips and ravines in the ocean crust, where submarines could hide. For bonus satisfaction, it was nevertheless interesting to discover how rifts were active and how ocean floors were getting spread.

But then, any scientific seafarer, who has the sensitivity to become enthralled by a Spreading Rift, just as easily could have become fascinated by coastlines and shores of continental crusts from which their ships sailed and to which those ships—though not necessarily the hearts of fervent explorers—were scheduled to return.

An ocean floor explorer could have noticed how continental felsic crust, resting on the same asthenosphere as did the mafic crust, might all along have been adding ocean floor by accretion, along its coast-lines. It would have been the same process. Why

should all credit for ocean floor formation be ascribed to a hot rift or a gap? **The continents on Planet Earth, indeed, were torn apart while all along new lithosphere was being created.** But it was the asthenosphere, welling up, that furnished the lifeblood of creation. It was not the lithosphere that would do rifting by itself. The difference between continental and oceanic lithosphere ranges between felsic and mafic, all of which are likely being determined by thickness, depth, age, and the caresses that either water or the atmosphere could have added in the form of cooling.

Why not call it “Expansion” Tectonics?

In 1996, at Missouri State University, when in response to the worldwide proliferation of “Plate Tectonics” theory I built my first website, *kwluckert.com*, I named my perspective “Expansion Tectonics.” A number of people adopted this label while, with some hesitation I began to neglect it. In the enterprise of university teaching, straight-forward antitheses are seldom appreciated for what they contribute. A straight antithesis to mainstream Steady-size Earth Tectonics, in those days, simply communicated opposition. In the refined climates of higher learning, single-step revisions seldom evoke anything better than irate attitudes. Nobody benefits from these.

We must seek a wide-angle perspective. Magnetic birthmarks of 200 Ma of spreading were found imprinted in the ocean floor crust, mirrored at right angles from the rift. A historical event, a consequence of the extensive reassignment of warships from World War II made this discovery possible. These vessels were placed in the service of oceanographic depth-sounding, scooping and drilling. As ocean plates continued to “spread” by hot lava, they can also be said to have “grown” from continents toward their far rifting edges—like fingernails grow to extend the reach of a hand. Continents reached and touched their parting neighbors with new ocean floor.

How about both—"Spread and Growth" Tectonics?

The word is out: Oceans are spreading along an only Mid-ocean Rift which splits and spreads all oceans. Continental shores are growing oceanic lithosphere along that same rift. What looks like "spreading" along oceanic rifts appears to be "growing" onto continental shores—onto shores which, over the past 200 Ma were lowered below sea-level to grow mafic crust.

Most ocean rifts appear to have moved sideways very little. On account of prior cohesion and tension among continents, of different speeds by which the flanks of rifts could widen, oceans, especially the Pacific, grew unevenly. A few continents "rifted" farther away from others, and some partial severances of lithosphere from upper asthenosphere occurred. But no continent detached completely from all its neighbors to go "wandering."

Five dimensions of thought are required, nowadays, to harmonize Plate Tectonics data with other systems of explanation. First there are the Three Dimensions of Space—breadth, length, and height. The fourth dimension represents changes that happen in the Flow of Time. For ordinary tasks and scientific orientation these four dimensions suffice. But as pertains to Plate Tectonics, where worldviews from American-English empiricism and German poetic naturalism had been converging a century earlier, **the Fifth Dimension which pertains to the dialectics of worldviews, history and language, has gotten engaged as well.**

* * *

During the 1950s, when this German-born wide-eyed student set out to find his trail into American academic empiricism—a mental attitude at the time still unfamiliar to him—some of America's stalwart Earth scientists, instigators of the Plate Tectonics Revolution, were seeking the grail of scientific Earth-theory in Germany. Thirty years after Alfred Wegener went missing in Greenland, his theory of Continental Drift—of *wandernde Kontinente*—suddenly was given commodity status. The new costumers

were highly successful American explorers of ocean floor. Prior to their pilgrimage to Germany they were able to enlarge the data-base concerning ocean floors beyond anyone's expectations, including their own. They have discovered mid-ocean ridges and the implied continuous Rift that was enlarging all the Planet's ocean floors. They discovered ocean-spreading and decoded magnetic anomalies which the process of spreading has imprinted into the seafloor. They enabled themselves to determine the relative ages of stripes and patches of ocean floor. In addition they succeeded with improving their topographical maps. By now some great refinements of satellite altimetry have been added as well.

Accolades given by representatives of Plate Tectonics science—to Alfred Wegener as their first founder—are a nice gesture toward German-born scientists in the English-speaking world. They are, however, a gesture that has bequeathed ambivalent consequences. **“Continental Drift” and “wandernde Kontinente” do not complement the worldwide Mid-ocean Spreading Rift which Plate Tectonics explorers have discovered during the 1960s.** While half a century earlier Wegener has argued for Continental Drift, he may indeed have alluded to the Atlantic separation as “rifting.” Nevertheless, having been granted first founder status on the basis of “Continental Drift” seems to have impeded progress in Plate Tectonics reasoning.

The landmasses which have gotten torn, by rifts that have widened and spread oceans, have nothing in common with “wandering” or “drifting” continents. All the seven continents on Planet Earth are still today touching at least one of their original neighbors. Therefore, tracing continents tectonically to their original positions is not all that difficult. However, what is difficult and even impossible to accommodate to Earth science are imaginary “drifters.”

Continental Drift theory has misled a majority of explorers into postulating “ocean floor subduction” and “convection currents in the mantle” —essentially to the end, that the continents, which an acknowledged founder has defined, would be enabled to continue wandering in his honor. Such honorary hypotheses do not help explain the known data. They only assist in the theoretical disposal of imagined surplus ocean floor; they clear the road for imaginary *Vagabund* continents. They enable scientists to think of continents as having wandered where none of them has ever gotten to.

Of course, Alfred Wegener wrote at a time before anyone knew about the Mid-ocean Spreading Rift or about its habit of leaving magnetic footprints in ocean floor lava. Greater help than Wegener’s hypothesis to Plate Tectonic science, therefore, is the new ocean floor chronology which the oceanographers themselves have created. The new Isochrone maps provide the best information about where on Earth, in the course of 200 million years, our seven continents may have been located in relation to one another.

To mention a little more about the aforementioned "Fifth Dimension" of research, pertaining to cultural relativity and context, I have in this Second Printing enlarged the Epilogue (pp. 147-150) with links to interdisciplinary causalities. Most Earth scientists probably would prefer not to pay attention to the inescapable "drift" that happens to important words in all human languages. But for the benefit of future generations of scientists it should be said, that all accomplishments of honing brittle scientific jargon, will require continuous maintenance and repair—very soon after stabilization has been achieved, or not less than once in every generation. The verbs "to wander," "to drift," "to rift," "to spread" and "to grow" have presently ended up on our workbench.

Excerpt from page 66

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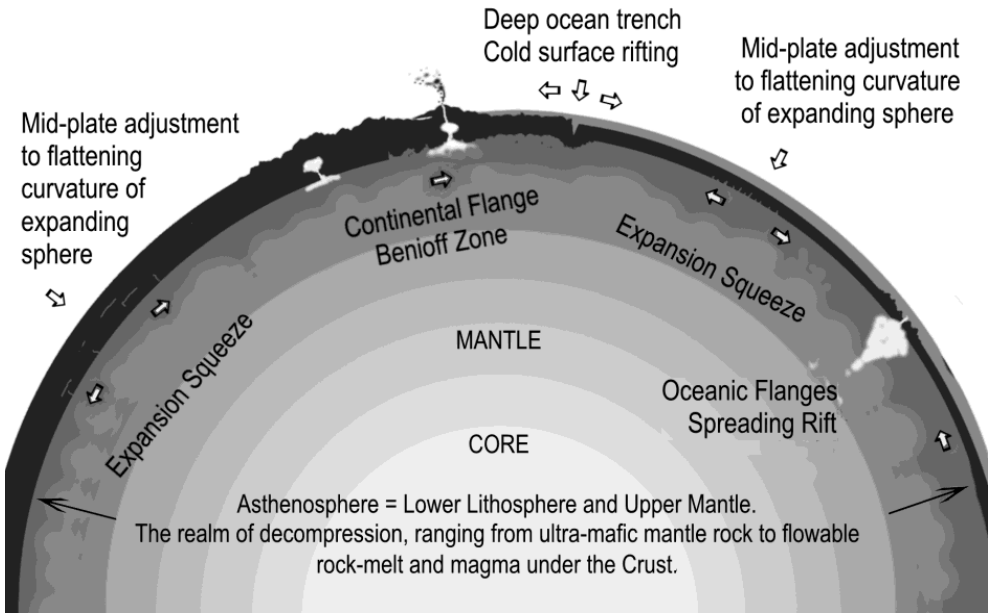


Fig. 14 : Schematic drawing, illustrating Expansion Squeeze, Flanging, Benioff Zone, Spreading Rift and Deep Ocean Trench.

Relative to the achieved height of the mountains, flatlands become flatter with every craton that collapses. Overweight mountain ranges may temporarily be squeezed, wedged in and propped up, but they are not fused tightly with crusts of the collapsing cratons. They remain standing and, from where we can observe them, they appear to rise, partly because lowlands around them must sink and adjust to the curvature of the expanding planet. To create her mountains, all that the Earth requires is a steady pace of expansion. The crust will buckle. Oceans and mountains will grow thereby, as if on their own.

Epilogue pertaining to the Fifth Dimension

Karl W. Luckert—Added for the Second Printing, in May 2016

A hint was given already in the Preface, that the worldview of this writer was shaped between two languages, while moving from a German into an English environment. Wegener's Continental Drift hypothesis traveled the same road. However, Plate Tectonics science took shape in America and traveled outward in the opposite direction. The fertile Romantic "drift" within the German language, over the past two centuries, can be illustrated with the evolution of a song—a *Wanderlied*, or hiking song.

Tectonics of a Hiking Song.—Wilhelm Müller, a poet of Dessau, Germany, in the year 1818 has written a round of lyric poems, titled "*Die schöne Müllerin*." Franz Schubert, in 1823, has worked this bundle of twenty poems into a musical and has made it famous. A simplified version of the opening song, "*Das Wandern ist des Müllers Lust*," was arranged for men's choirs by Carl Friedrich Zöllner, in 1844. Arguably, this song has become the best known German folksong for millions of people.

Any person who went hiking could feel inspired by the four-voice Zöllner chorus, which loudly glorified the obligatory *Wanderschaft* of craftsmen. When an apprentice in a craft graduated, he was officially declared a "free fellow" (*Geselle*)—as this author himself was "*freigesprochen*" in 1952. The fellow could then go wandering another three years and work for several masters, far away from his home area. This was required before he could become a master of his craft. Academicians also travelled the road, but their journeys were not registered or controlled by guilds.

The educational effects of Zöllner's choruses were incidental, but they conveyed all the usual sentiments of the Romantic Period—the metaphors and hyperboles of love, longing, freedom, happiness, suffering, as well as contemplations of death and the prospect of eternal rest. For example, the miller-*Geselle*, in the Müller lyrics, appears driven by his love of a beautiful miller's daughter. When that love was rejected, he succumbed to self-pity and drowned himself in the mill-creek—or at least thought about doing so.

To orient Alfred Wegener's book, "*Die Entstehung der Kontinente und Ozeane*" (1915) in an evolutionary context, within Germany, we should focus specifically on the Fourth Stanza, below. There reverberates the sentiment of regarding stones as fellow wanderers. This metaphor elucidates why Wegener could have reflected on continents as wanderers.

Rushing mountain streams, rolling and thundering pebble stones or boulders, were actually seen only by those wanderers who braved heavy thunderstorms in the mountains. But with the help of music, the masses of ordinary folk could dream about wandering alongside wandering stones, which then would dance and run ahead of them. All laborers would have loved to wander more, and work less.

Das Wan - dern ist des Muel - lers Lust, das Wan - dern ist des Muel - lers Lust, das
 Wa - an - dern. Das muss ein schlech - ter Muel - ler sein, dem nie - mals fiel - das
 wan - dern ein, dem nie - mals fiel das Wan - dern ein, das Wa - an - dern.

2. Vom Wasser haben wir's gelernt,
 vom Wasser haben wir's gelernt, vom Wasser!
 Das hat nicht Rast bei Tag und Nacht,
 ist stets auf Wanderschaft bedacht,
 ist stets auf Wanderschaft bedacht, das Wasser.

3. Das sehn wir auch den Rädern an,
 das sehn wir auch den Rädern an, den Rädern!
 Die gar nicht gerne stille stehn,
 und sich mein Tag nicht müde drehn,
 und sich mein Tag nicht müde drehn, die Räder.

4. Die Steine selbst, so schwer sie sind,
 die Steine selbst, so schwer sie sind, die Steine!
 Sie tanzen mit den muntern Reihn
 und wollen gar noch schneller sein,
 und wollen gar noch schneller sein, die Steine.

5. O Wandern, Wandern, meine Lust,
 o Wandern, Wandern, meine Lust, o Wandern!
 Herr Meister und Frau Meisterin,
 laßt mich in Frieden weiterziehn,
 laßt mich in Frieden weiterziehn, und wandern.



Fig. 30. Dora and Karl on their visit to the Great Bight, September 2006

The contemplated behavior of stones, for many German readers, belonged to the virtual reality of physics and nature, as well as of whatever knowledge could be acquired under the influence of music. These were the people whom Alfred Wegener addressed with his theory regarding drifting and "wandering" continents.

Almost a century had passed since Wilhelm Müller penned his words about dancing stones, and thereby fused the attributes and behavior patterns of stones with those of human wanderers. In 1912 some of these words enabled Alfred Wegener to think and communicate about continents that could indeed be wandering. And wandering stones and wandering continents did make some sense when they were contemplated against the background of music that already had inspired most everyone in Germany.

As Carl Friedrich Zöllner has amplified Müller's and Schubert's impact perhaps a thousandfold, by way of organizing men's choirs, so Alfred Wegener has enlarged Müllers wandering stones to the size of continents, to fit his world map. It was henceforth possible to contemplate, in the German language, the continents as being wanderers. The Romantic marvel, of stones traveling in water, became the science of Plate Tectonics.

It seems quite inappropriate to answer the Müller-Schubert-Zöllner-Wegener group with only the latterday scientific language of Plate Tectonics. I am aware that added poetry will not change the history of science. But for the sake of perspectives on possibilities, one should wonder what type of balancing notions, during the Late Romantic Period, could possibly have slowed down the linguistic drift in German, toward drifting continents.

I must honor Wilhelm Müller by way of responding in his own style. But the stones on which I dare sit, nowadays, no longer are of the dancing or wandering variety. But by replacing three stanzas of Müller's overture, I might just also avoid wanting to raise mountains by collision—or to keep something from growing larger by way of trying to subduct its skin.

3. Der Müller geht den Weg entlang
den Wegener erbauet han, die Wegener.
Der Wegner ruht auf Steinen aus.
Er räumt sie sich vom Weges Lauf,
Er räumt sie sich vom Weges Lauf, zum Bauen.

4. Die Kontinente reisen nicht,
doch um die Schollen reißen sich, die Meere.
Die Erd erfüllt sich innerlich,
Mit Brunst und Feuer weiten sich.
Mit Brunst und Feuer weiten sich, die Meere.

5. O Wandern, Wandern, hin zum Ziel,
o Wandern, Wandern, hin zum Ziel, zum Bleiben.
Der Wan-derer kann nicht mehr gehn.
Am Grab ein Stein bleibt bei ihm stehn.
Am Grab ein Stein bleibt bei ihm stehn. Er bleibet.



For music to this inscription see the "hr-menu," 2016, at "Songs awaiting Sounds," Hymn 16, "Rest by the River."