Ott Christoph Hilgenberg in twentieth-century geophysics

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Abstract

The main points of the life and scientific production of Ott Christoph Hilgenberg (1896-1976) have been reconstructed. The events took place between America and Berlin: in America from 1925 to 1928 the young Hilgenberg, with a diploma in Mechanical Engineering, worked as a Geophysicist in an oil prospecting company. It was there that he probably developed his interdisciplinary ideas, which, influenced in various ways by the European cultural climate, brought him into the field of global tectonics. He conceived a theory about the expansion of the Earth based on the nature of the gravity field. In 1933, the theory was published in his classic work *Vom wachsenden Erdball*. Upon his return in Germany he performed various types of research at the School of Engineering, then that of Geology and Paleontology at the Technical University of Berlin. He was also briefly involved as editor of the scientific publications at the Technical University of Berlin, where he made a contribution towards saving the book collection as the war ended. During the years spent in Berlin, he continued to refine his elegant version of the theory of Earth's expansion publishing articles and books on this subject up to the last years in his life. The importance of Hilgenberg lies in the fact that he marks the beginning of the integration of various scientific disciplines from Physics to Paleontology and Paleomagnetism, in support of a universal tectonic theory, and that he made paleogeographic reconstructions on globes with smaller radii than the present one. All those who have worked or are working with one of the versions of expansion tectonics owe him enormous gratitude for his inspiration and for the scientific and moral lesson of fifty years spent in unflagging defence of his ideas. The material gathered and kindly made available by his daughter Helge has been indispensable for this recalling.

The flourish of ideas from the 19th to the 20th centuries.

The history of the idea of Earth's Expansion began in 19th century. It grew out of the climate of vivid imagination and bold new hypotheses, typical of this time, and laid the foundation for enormous progress in the century that followed, based on verification

From Scalera, G. and Jacob, K.-H. (eds.), 2003:
Why expanding Earth? – A book in honour of O.C. Hilgenberg. INGV, Rome, 25-41.

of these, on their development and in-depth study (Scalera, 1997). From the beginning of the 20th century onward Hilgenberg had many followers in Germany, the country which, with Wegener, was the first to consolidate the mobilistic ideas which were gaining supporters in geology. Wegener had certainly lived in a climate where geological ideas were burgeoning once again (Dick, Snider-Pellegrini, Humboldt, Stübel, Green, Mantovani, Taylor). The writings of expansionists and even contractionists had made their contribution (Federico Sacco, 1906). Wegener had been the one to compile and organise them, and had also attenuated the impact of the insights which seemed at the time too advanced or diametrically opposed to a cultural environment where the philosophies of nature were modelling theirself on the findings of Michelson and on Einstein's ideas of geometrising space. An episode occurred involving the German meteorologist, who was the author of the famous book on continental drift. He was encouraged by French scientists to quote the work of the Italian Mantovani. Their reasons were somewhat chauvinistically motivated, and they wanted the predecessors at least to be brief cited (Scalera, 1997). Naturalised French, throughout his life, Roberto Mantovani had been the first to defend the idea of Earth's expansion as the cause of drift. In the last edition of his work, Wegener indeed admitted the resemblance of the Italian's ideas on continental drift (he had also published a first map of Pangea). The German, however, made no mention of the central core of the ideas of Mantovani, who spoke of the increase in volume of heavenly bodies. Readers judged Mantovani to be simply a *drifter*: expansion was judged by Wegener to be a form of extremism to be avoided.

When Ott Christoph Hilgenberg published his classic monograph *Vom wachsenden Erdball* in 1933 he may very well not have been aware that the expansion theory had come earlier. Probably, the first purpose of the Berliner was to try to explain universal gravitation, as documented by its first papers of 1929 and 1931. However, he dedicated the book of 1933 to Wegener as the original inspiration for the ideas that he had developed in a yet more general scheme, including the expansion concept. Mantovani's name does not, in fact, appear in quotations or in bibliographies of his numerous works, published in the course of a long career in science that lasted more than fifty years. Thus, the details of the historical progression of ideas that inspired Hilgenberg, how his conceptions came about, and what precise influences there were remains unsolved.

At times, ideas pursue tortuous and obscure paths. It can well be that the first works on Mantovani's earth-expansion ideas (1889) and those of Yarkovski (1888) could have come to – and rooted themselves in – the German culture of the beginning of the twentieth century in mysterious ways. In any case it is evident

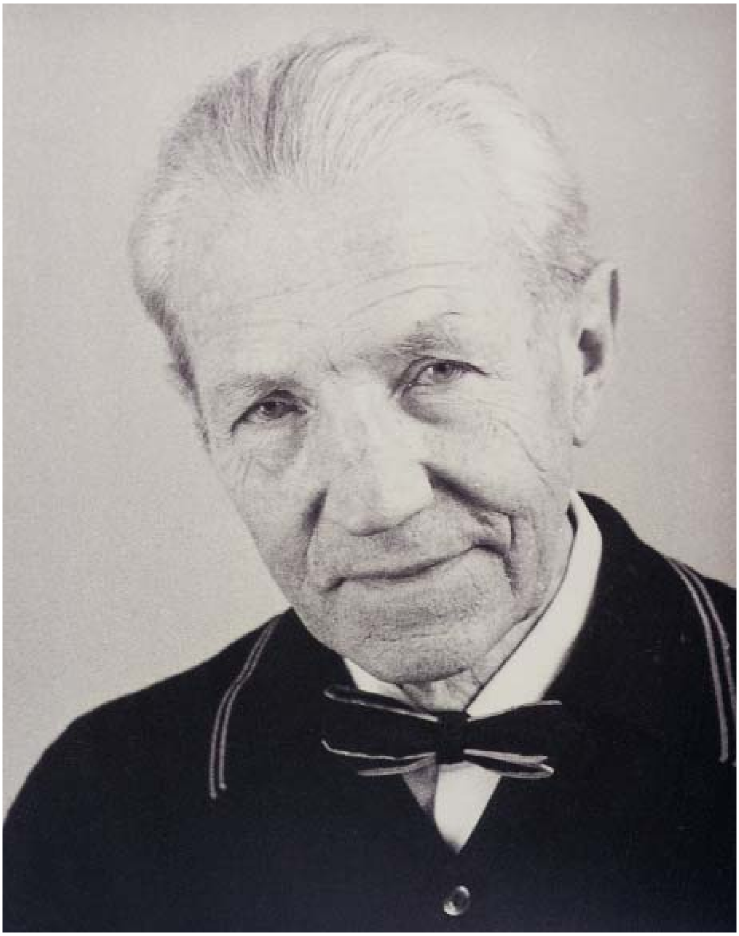


Fig. 1
Ott Christoph Hilgenberg in 1970.

that expansion idea was present at a popular level at the beginning of the century in America and Western Europe from the succession of work of Mantovani (on a popular Science Magazine in 1909) and Hixon (again in a popular magazine, in 1920). Afterwards, in Germany, the planetary expansion conceptions were embraced and defended by various scientists (B. Lindemann, Joseph Keindl, and, to this very day, valid defenders such as Klaus Vogel and Johannes Pfeufer) who have written various papers on the subject. It is certain that only the book of Lindemann from 1927, taking a purely geological and tectonic approach and much less general in its conceptions, was known and quoted by Hilgenberg in 1933. It is worth considering the idea that Russian cultural circles, beginning from Yarkovski (1844-1902) ideas, just on nature of gravity, may have had some sort of influence on the ideas of the Germans. Indeed, many of them, including Hilgenberg, knew the language. Bogolepov began the publication of a series of articles in Russian on planetary expansion as early as 1922.

The role of Hilgenberg's trip to America (May 1925 – Sept. 1928) as a geophysicist involved in oil prospecting at the beginning of his career should be assessed. There, in his work as an oil prospector, he may have come into contact with ideas transmitted orally or in English-language articles and books by mobilists such as Richard Owen of the University of Indiana (1810-1910, *Key to the geology of the globe: an essay*; from 1857), Osmund Fisher (1817-1914, *Physics of the Earth's crust*, from 1881, in agreement with the idea of George Darwin that the moon had separated from the earth and was the cause of mobilism), W.H. Pickering (in a work of 1907, likewise a follower of G.Darwin), Frank Bursely Taylor (1860-1938, the true and great precursor of Wegener with his study of 1910: *The bearing of the Tertiary mountain belts on the origin of the Earth's planes*, and that of 1926 *Greater Asia and Isostasy*), Howard B. Baker (a defender of the idea of continental drift with various studies starting in 1911) as well as Hiram W. Hixon (who criticised contractionism in favour of planetary expansion in 1920).

Now it is clear that positions bordering on the limits of extremism were spreading in Western Europe in the 19th century, even regardinig the possibility of continental drift itself. The Scotsman Thomas Dick, was already offering a Wegenerian vision of the separation of the continents in 1838 in his book *Celestial Scenery; or The Wonders of the Planetary System Displayed* (Goodacre, 1991), and Snider Pellegrini, in his book (*La création et ses mystères dévoilés*) which was also the case for the debates that took place thereafter (Misc. Authors, 1859). Other debates must have been going on from the first half of the 19th century on, but very few traces of these remain. They involved those who supported the idea of rapid continental drift (a conception which dates as far back as the 17th century: Placet, 1666) – and extremely close to the historical times – often based on a mobilist interpretation of the Atlantis myth, and the Plutonists who then prevailed. For example, Leopoldo Pilla (18XX-1848), born in Venafro and professor in Pisa, on p. 301 of his famous *Trattato di Geologia (Treatise of Geology)* of 1847 had harsh words for the 'exaggerated ideas about the effects of earthquakes,' opening straits, separating continents, and the support that such ideas had received from Plato's Atlantis story. The abhorred theories in favour of Atlantis were even mentioned in his eulogy (he was killed in 1848 during the Battle of Curtatone) delivered in Sondrio in 1874, perhaps with a bit of malice aforethought. The eulogy was given by Domenico Lovisato (1842-1916) who had earned himself the reputation of being Wegener's precursor due to the mention in that one manuscript (never published) of some mobilistic ideas linked to the Atlantis myth (Imeroni, 1927). Echoes of, and agreement with, the myth narrated by Plato can still be found in the last works of Roberto Mantovani (1927: *L'Atlantide et la découverte de la dila-*

tation planétaire) on the wave of favourable opinions given by famous geologists and academicians up to the first few decades of the 20th century (Pierre Termier: *A la Gloire de la Terre*, 1922).

The discrepancy with modern physics

Hilgenberg found himself thinking and working at the end of this period in which more or less well-founded or extremist ideas flourished in Berlin from the 10s to the 30s (The first papers of Wegener belong to the time lapse from 1912 to 1915). There was great fervour for the cultural exchanges between East and West, and Berliners were shaken by the tumultuous political events. In Germany, the young researcher had the advantage of moving about in an environment more favourable to mobilism than the conservative atmosphere that prevailed in England. Westward continental drift had already been defended by H. Wittstein in 1880 and, later on, in 1912, by L. Schwarz, based on similar hypotheses. Hilgenberg, however, was at a disadvantage: his ideas on variations in the Earth's volume were included among others which, as we saw, had been considered too advanced, in an academic world that was only beginning to discuss continental drift, contenting themselves with the assumption that the Earth's radius was a constant. For the academicians the idea was, to be sure, serious, but still based on little data, and therefore to be submitted to subsequent verification. There was another disadvantage for the theory of expansion coming from Berlin. It concerned not only the Earth, but also claimed to be wider in scope than that of Wegener, assuming as it did that there was a cosmological agent that affected the dimensions of all planets and heavenly bodies. Such a theory was bound not to find support in contemporary physical theories. Basic physics had entered that exciting period of the discovery of atomic and quantum phenomena, the new Promethean fire and the renewed concepts of space and time that had originated with relativity (special and general). This enthusiasm moved more and more towards reductionism, and became all absorbing in physics research. It led to the extraordinary technical progress that we enjoy today, to the attempt to describe all phenomena by the quantization method, as well as those (*e.g.* gravity field) had heretofore eluded such a method, but also to underestimation of the role of 'quantum paradoxes' in the revelation of our poor knowledge of the world (the wave-corpuscle dualism, non-locality, Shrödinger's cat – in the writer's opinion they all had a common origin) and otherwise, for political and military reasons. Among other things, there was also an ever greater tendency towards specialisation and pragmatism in university General Physics courses. There was less space for general courses in Earth physics and astronomy. As a result, graduates were produced to be used in nuclear-physics laboratories, or as mediocre secondary-school teachers expropriated from History of Sciences, the Sky, or the Earth. All this was done in the guise of 'forming the mind.'

The negative role played by relativity in undermining the development of Hilgenberg's ideas was that of building an image of the world in which space is a geometric entity, static, all in all, and it is deformed by the presence of masses. Space became a sort of rough terrain in which masses 'rolled' along paths which could no longer be rectilinear but which followed the geodetic curves of the 'terrain.' Hilgenberg, on the contrary, for whom the nearly doubling of Earth's radius since the Paleozoic era required the continual absorption of energy-mass in heavenly bodies, was addressing himself explicitly to a Cartesian sort of space, antithetical to Einstein's conception. He required space with material characteristics, and which contained energy density. Far from being static, it had to have dynamic characteristics, and could be dealt with by fluidodynamics: motion itself, and had to belong to space hence time as well. The conflict between the Berliner and the avant-garde physics of that era meant a certain isolation in scientific circles, partly a consequence of the error of a complete failure at the beginning to accept theories of relativity. He supported his anti-relativistic ideas, quoting experiments that were flawed by spurious effects, such as Miller's. This position became more moderate as time passed and he arrived at a more serene and mature judgement and acceptance – with some reserves – of relativity theories in his final synthesis of 1974, two years before he died. Hilgenberg was further isolated thanks to his rigorous decision not to yield to the request that he belong to the NSDAP in order to obtain a university chair that was already prepared for him. The question arises as to whether or not it was for better or worse for expansion theories that he was unable to obtain a chair in Mechanical Engineering. As a qualified member of the academic body, overburdened with official duties in a discipline that did not coincide with his primary scientific interests, could Hilgenberg have gone on for about fifty years with his increasingly in-depth studies on the expanding Earth? He showed dedication and continuity in the 'privileged'position of a researcher whose work crossed over many disciplines, and he was protected and nurtured by the academic body that had not been able to co-opt him entirely.

Hilgenberg's scientific works

Ott Christoph Hilgenberg is certainly renown among historians of Earth sciences for his small, classic volume of 1933 *Vom wachsenden Erdball* (*The Expanding Earth*). Few people are familiar with his preceding works: *Das Rätsel Gravitation gelöst* (*The Solution to the Mystery of Gravitation*) of 1929 and *Über Gravitation, Tromben und Wellen in bewegten Medien* (*On

Gravitation, Vortices and Waves in Moving Bodies) of 1931, in which hypotheses on the physical principles by which heavenly bodies gain mass were illustrated. Only a summary of these principles can be found in his work of 1933. It is important to note that Hilgenberg, in his research on expansion, starts off not with a work on geology, tectonics or global geodynamics but in the spirit of a physicist. The first question he asked himself was the wherefore of gravitation and the expansion of planets. Only later, once these physical principles had been established, did he pursue for his entire life, the question of how expansion had manifested itself, seeking to set forth in detail the progression of palaeogeographic reconstructions that seem so marvellous today (Fig.2). The method on which they are based is still totally modern, bringing together, as it does, data from many disciplines.

The physical principles adopted by Hilgenberg are likewise highly advanced conceptions. He states that a model of space can be constructed that accounts for the force of gravity, simply by assuming that any mass, any heavenly body, is a 'hole' towards which ether, or space, whatever it may be called, flows. Hence this Cartesian ether-space with a slight energy density, is concentrating inside planets, giving rise to new atoms and particles in a conversion process which is still unobserved and totally unexplained. Indeed, even today, physics cannot accurately estimate the energy content of space. The famous astrophysicist Michael Turner (2000) comments on the present situation in these words:

> 'Although the existence of the quantum-vacuum energy has been known for some time, physicists still have no clear idea how large it is. Estimates range from the absurdly large to the simply insignificant.'

Hilgenberg ends up, perhaps without realising it, setting forth an equivalence principle which is even more solid and symmetrical than that formulated by Einstein in his general relativity: if a force is needed to accelerate a mass in space, then a force manifests itself if space is accelerating with respect to a mass. It follows that the gravitational field is nothing but the effect of the accelerated flow of space towards the massive planetary body. The discrepancy with respect to the contemporary physics was great, and this, together with the neat disagreement concerning the dominant political view of the time, caused a severe rejection of his thesis from the examination committee.

Once he had identified the mechanism by which a heavenly body expands, feeding itself on space, Hilgenberg must have immediately felt the need to quantify the rate of energy supplying the masses and the planets. As so, for the first time in the history of physics, the Earth became a veritable test body, which could be used to examine cosmological processes. Working with palaeography, a science which can allow scientists, moving back in geological time, to return to the lesser dimensions of the Earth, it is possible, by setting conditions, which are crude on the surface but conservative, to calculate how much mass has been added to the initial amount every hundred, one thousand, ten thousand years, assuming an exponential increase. In the decades that followed he attempted to refine the estimate of Earth's past dimensions by reconstructing the continental crustal dress when it had not yet been shredded and separated into fragments by the increase in internal volume and by the growth of surface area of the ocean crust.

Hilgenberg's work was always interdisciplinary and a link among various science, and he was always aware of the fact. In one of his curricula, he says:

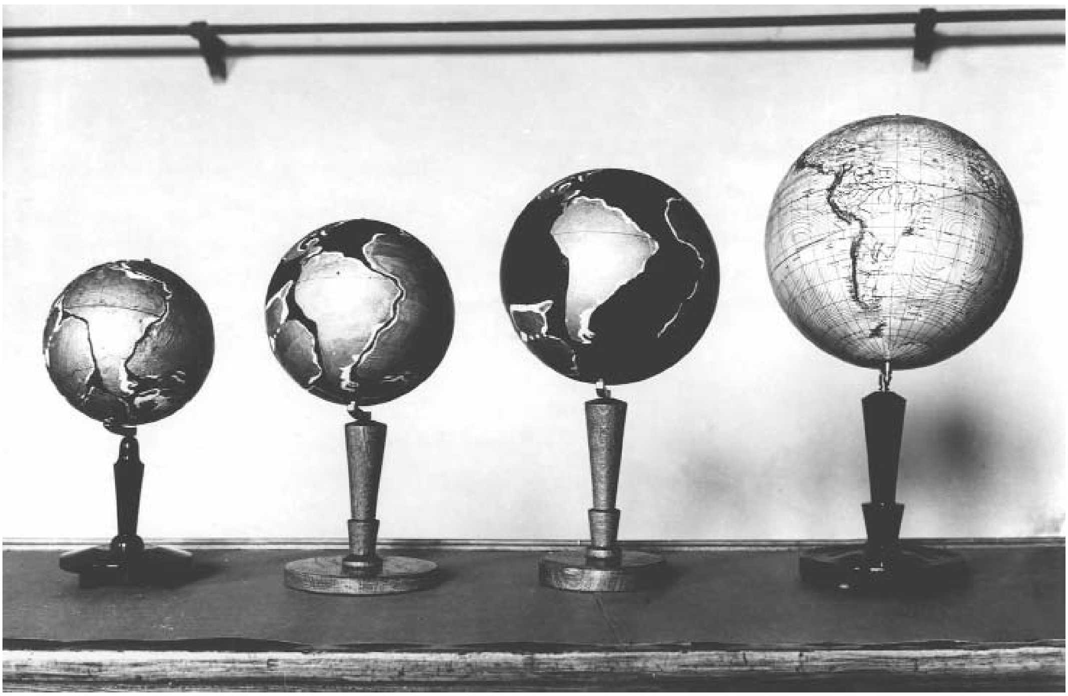
> '[... ...] With the savings I had put together in the United States (over 20,000 Marks) I thought I could devote myself to perfecting the theories I had worked out with regard to some problems of physics, and more than anything else, document those theses with a series of experiments. I drew up the three reports which I enclose. The experiments described in these reports were carried out at the Technische Hochschule in Berlin. They refer mainly to four new fluid-dynamic effects that I have worked out and defended, one of which has already been completely proven by experiment (see the report of 1933) [... ...]. According to these four new fluid-dynamic effects I determined the two fluid-dynamic effects already known of. I believe I have discovered important relationships between physics, astronomy, meteorology and geophysics.'

Indeed an indissoluble link is immediately perceivable in his works between space in Cartesian terms or, in some ways, in those of Giordano Bruno, a meteorology in which material vortices occur in the natural reality of atmospheric disturbances, experimentation in mechanics and fluid dynamics, geophysics that becomes a large-scale test for his philosophical and experimental ideas, projecting out towards levels of greater and greater generalisation, and he thus provided a test for cosmology. Selected arguments of Hilgenberg about all this can be read in this book, in English translation, in the *Unpublished manuscript* (this volume pag.178-28). Very important is the connection between the ether flow towards the central star, the Sun in our planetary system, and the angular momentum state of each planet. The particular effect he studied by laboratory experiments, the inverted Magnus effect, permits a continuous increase of the spin of the planets, which pass from their initial retrograde rotation state (results of the mutual differential movement of the durst particle of the saturnian-like rings from which the planets originates) to a zero rotation state and finally to an inverted spin. In the Hilgenberg view the angular velocity of all the celestial bodies continue to increase until the spin is sufficiently high to produce a detachment of a portion of the equatorial crustal material, which immediately constitutes a durst ring (a future moon), while the planet's angular velocity irregularly decreases and a new cycle starts. This is the part of the Hilgenberg thought we should consider less valid today, because of new results of planetology and celestial mechanics. We know that a planet, because of the tidal friction and other effects (among them Earth expansion) reach a final state of synchronous rotation and revolution, the same that today is experienced by the Moon. Also, as that concerns the durst ring espulsion, none the solar system planets show actually a strong angular velocity near to the needed one able to produce the expulsion event. Nevertless, this part of the Hilgenberg world view is important for the history of the XX[th] century ideas because it was also shared with other member of the scientific community (see Egyed 1960), and not necessarily with expansionists.

As that concerns his more geophysical papers, although the Berliner never quoted the works of the mobilists writing in English referred to at the beginning, in his first geodynamics text, his work at an oil-prospecting company in the U.S.A. has in the references a preponderant number of quotations from the geological works of American scholars. Among these, a great many relate more or less directly to the problem he considered crucial: that of the geography of Laurentia in the Paleozoic era (Fig.3). Hilgenberg concluded that an immense counter-clockwise megashear crossed Laurentia from northwest to southeast, hence the North American continent appears with its western part displaced towards the northwest in the Paleozoic, on an earth 60% per cent of its present size, without large oceans or deep seas.

Fig. 2

Photo of Hilgenberg's wooden globes printed from a photograph plate 13x18cm in fragments recovered in Berlin. Retouching has eliminated fractures in the plate yielding a neat documentation of what the globes were.



The overall evolution of the Earth was modelled on three wooden globes whose sizes increased (Fig.2) and a modern geographical globe was chosen as the final model. Hilgenberg's original globes, at least those in the possession of his daughter, Helge, were destroyed by time and moisture. They would have provided unique documentation of an important aspect in the progress of human conceptions of the planet Earth's evolution, as well as that of the entire Universe. Other copies of the globes, perhaps built for the subsequent post-war work, where damaged irreparably in 1968 by irresponsible students.

Hilgenberg's purpose was to reassemble all the fragments of Pangea into a coherent mosaic, so as not to leave more space for the oceans. He followed the classic reconstruction of Wegener for the Atlantic and Indian Oceans, albeit with variable radii, keeping India in contact with Asia, as Wegener had done, and in contrast with modern plate tectonics (an easier task on an expanding Earth). The solution proposed for the complete closing of the Pacific completely departs from that of Wegener as far as the Australia-Antarctica block is concerned, however. The configuration chosen puts Antarctica side by side with the coasts of Chile and the tip of the Antarctic Peninsula wedged between Central America and Peru, parallel to the Californian Peninsula (Fig.4). Australia was in the polar position with its present south-western coast alongside Tierra del Fuego. The Asian Far East, Indochina, reached back to the point of touching the north-western coasts of Australia. The expansion of the planet then conveyed the continents to their present positions. Even though this solution for the Pacific is not in agreement with the most up-to-date paleomagnetic data, it is still a valid attempt, the first of its kind, to transpose geographic outlines among globes of different radii in a rigorous way. Hilgenberg moved paper outlines of continents from one globe to a smaller one, eliminating some thin radial slices to compensate for the positive variation in curvature: this was the equivalent of adopting equidistant azimuthal projection with the centroid of the continent as the centre of projection (Fig.6).

The proposals of the Berliner to explain various regional tectonic phenomena, such as the formation of rifts and grabens, the overall state of the outer crust, the overlapping and the sinking of the edges of continents, are equally interesting. An essential role in explaining these phenomena is played by mechanical forces that a spherical continental cap undergoes as it attempts to readjust to a flattening surface curvature. He put forth these solutions several times during his life as a scientist. Of great interest as well, among the works of his old age, is the explanation of arc-trench zones. This, too, must be considered in historical perspective, in a post-war period when many solutions for the existence of deep, so-called Benioff seismofocal areas were being proposed. Hilgenberg thought that the inclined structure below the troughs

Fig. 3
The counter-clockwise megashear crossing North America diagonally.

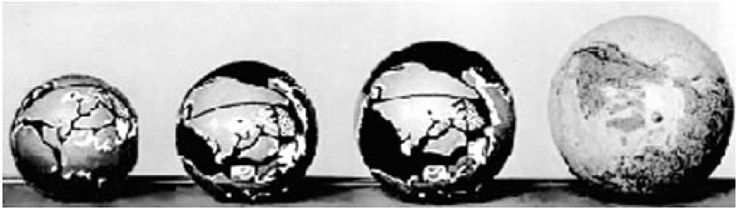
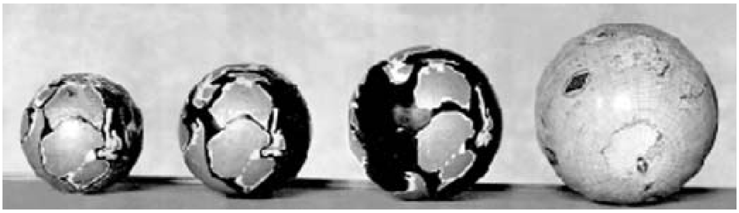


Fig. 4
The position and kinematics of the Australia-Antarctica block on Hilgenberg's globes. From an original photograph.



was the result of the rising of dense matter, dunite coming from the deep mantle, due to separation from expansion between oceanic and continental crusts. Considering the fact that modern seismic tomography shows a cold inclined slab extending as far as 700 km under the crust, and that some rising hot matter in adiabatic decompression must cool off, such a conception might once again be appraised as geoscientists' ideas about our planet evolve.

Thanks to Hilgenberg, great progress was made in paleogeographic methodology. For the first time, paleopoles were used on a variable-radius globe to find the right angle and distance of the continents from the geographical pole. The problem involved is not trivial, since it can be demonstrated that if a sole magnetic pole is observed by various observers in various places on a sphere, and if the crust on which the observers are located is transposed to a larger sphere, with less curvature, the directions and distances of the old pole are dispersed in a characteristic way, the position of the paleopole changes for each observer, depending both on the law of cartographic transformation (equal area, equidistant, similar, *etc.*)

Fig. 6
The desk and the simple instruments Hilgenberg used to assemble continental outlines on different radius globes.
The photo came from the 1933 booklet 'Vom wachsenden Erdball (The Expanding Earth).'

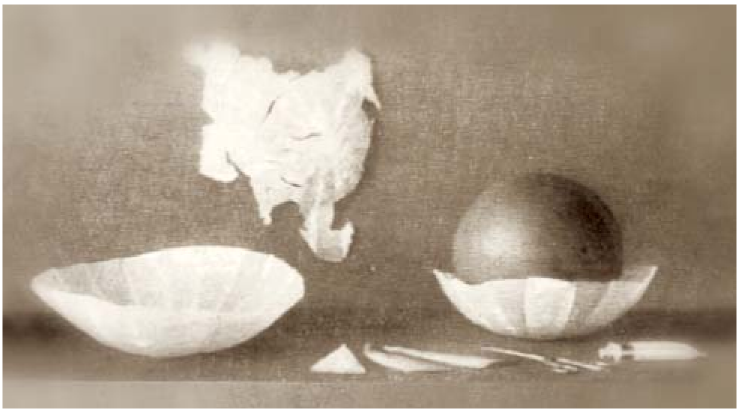
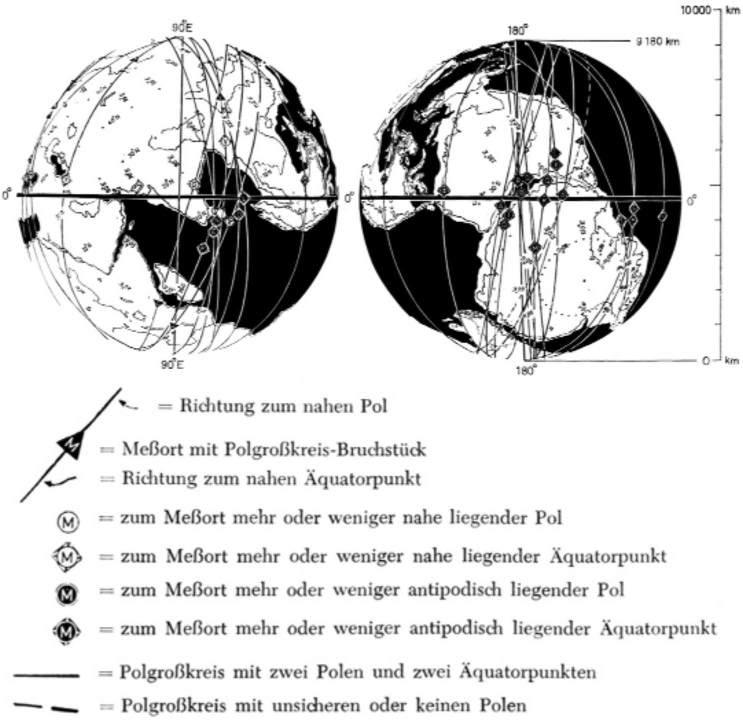


Fig. 6

The reconstruction of the Permian with the Earth's radius of 4590 km. from the work of Hilgenberg of 1965. The paleopoles, the measuring sites, and the azimuth paleopole-site appear on the orthographic-projection maps for the first time on an Earth whose radius was smaller than it is at present. The increase in Earth's radius is calculated to be 4 millimetres per year.



and on the fact that a different transformation law must be applied to the paleopoles for which the distance in degrees is maintained between sampling site and pole. If we think that this is hardly simple today with computer assistence, we can immediately imagine what a monumental task Hilgenberg accomplished. In 1965 he published a series of 5 reconstructions from the Permian to the Eocene in the *Geologische Rundschau*. There was a total of 30 projections of the globe at different paleoradii, with different centres of projection together with the representation of orientations and paleopole-site distances (Fig.5).

Despite the fact that he never obtained an academic position in keeping with his expertise and culture, Hilgenberg became, in his lifetime, a point of reference for those who dealt with global geodynamics, tectonics, and palaeography and kept up a lively correspondence with them. He took part in the heated debates of his time and had the feeling of being on a different plane. Very few people, in fact were capable of understanding him. His attitude can be gleaned from the title of one of the sections in his work of 1974, the crowning point of years of dedication to the theory of expansion. It fills an entire issue of the journal *Geotektonische Forschungen*, almost 200 pages, and only one section, the third, is in English. The title is: *Debate about the Earth. The question should not be:'Drifters or fixists?' but instead: 'Earth expansion with or without the creation of new matter?'*. It took the form of an open letter to Wilson, Beloussov and van Bemmelen. Geophysics crossed into the territory of cosmology, and, indeed, became its guide. This was, however, a moment in history when scientists went from a discussion of various possible cosmologies, to the alleged experimental proof of the big-bang theory, thanks to the discovery by Penzias and Wilson of the microwave background (1968), and, in the view of the proponents of the Cosmic Egg, the Earth must remain ancillary to the evolution of the cosmos, whose destinies are set at the initial instant of the great explosion. In this last work, recognising that others had formulated the laws of hydrodynamics before himself, that were necessary to his vision of the world, he mentioned Riemann, among the others, and the initial attempt of the latter to formulate the rheological laws of the ether that took their inspiration from Bernoulli. Setting an energy density for the ether at zero, carrying out a simple mathematical conversion, and adding the fourth time coordinate, Riemann accomplished a formulation that became Einstein's general relativity in which only the curvatures of space time are present. Hilgenberg thus claimed that there was an analogy between relativistic and hydrodynamic treatment and the possibility that they could converge in future. In his last work of 1974 he clearly points out that stars cannot grow indefinitely and the fact that once a star has reached a critical mass, such that the incoming velocity of the ether equals that of light, the star becomes an

Fig. 7

Hilgenberg at work in the 50s constructing wooden paleographic globes.

object that no longer emits anything. It collapses within itself. This concept is equivalent in every way to that of the black hole in modern astrophysics.

In his last working years, Hilgenberg concentrated above all on cosmology and its relationships with geophysics. Death came to him as he was working on the last corrections of a typed text called *Erdentstehung und Entwicklung*, a long survey of the relationships between planetary expansion and cosmology. Now, the manuscript is being translated at the INGV and selected parts of the contents are published in this book.

The Life of Hilgenberg

Hilgenberg could be said to have had an almost symbiotic relationship with the Technical University of Berlin. It can, in fact, be stated that the Technical University was created by him, taking advantage of the confusion in Berlin, as it was being occupied by the Allies (see the biographical contribution, in this book, of his daughter Helge). He, in fact, was the one who recovered and improved the book collection of the school, by negotiating with the Allies and managing to procure the return of science books that were being stored in the Soviet sector. People must have felt a great debt of gratitude towards Hilgenberg, who became a director involved , for a short time, in library activities.

More personal events in the life of Ott Christoph Hilgenberg has been taken from various curricula recovered by his daughter and are contained in the paper of Helge Hilgemberg (this book) together with a recollections of her father who apparently led a difficult and agitated life. A singular person, simple, but at the same time rigorous and determined, emerges from this documentation.

Conclusion

This is the historical contribution I offer to this collective book. The purpose was to recall a person who is almost totally unknown today in scientific circles, but who is associated with those lines of research that played an important role in basic research in 20th century Europe. Ott Hilgenberg and his thought, have contributed and still contribute to livening up the scientific debate, both thanks to the inspiration they have offered and continue to give to all those who are dealing with the same problems, and as a firm point of comparison for those who happen to be pursuing competing ideas.

Convinced as we are that the issue of planetary expansion will become an important subject in the new millennium, there is a final consideration we would like to emphasise: it seems strange at times that the great scientific achievements accomplished in an historical period, with access to intriguing fields of exploration far from the realm of common sense, with the triumphalism that goes along with it at times, highly justified in certain areas, can, in some cases, conceal, silence, or seriously delay as unjustified, demands for further investigations coming from associated fields when these fields give indications of strong opposition or of need for a completions of the flow of dominating ideas.

References

Bogolepow, M., 1922: Die Entstehung des Antlitzes der Erde. *Semlewedenie*, III-IV.

Bogolepow, M., 1930: Die Dehnung der lithospäre. *Zeit. Dt. Geol. Ges.*, 82, 206-228.

Bourcart, J., 1924: Les origines de l'hypothèse de la dérive des continents. *Revue Scientifique*, 563-564.

Carey S.W., 1975: The Expanding Earth – an Assay Review. *Earth Science Reviews*, 11, 105-143.

Carey S.W., 1986: *La Terra in espansione*. Laterza, Bari, pp.346.

Fossa-Mancini, E., 1924: La recente teoria della deriva dei continenti in un vecchio manoscritto di Domenico Lovisato. *Urania*, anno XIII, n°6, November-December, 123-129.

Goodacre, A., 1991: Continental drift. *Nature*, 354, 261-261.

Gohau, G., 1991: Considération historiques à propos de la théorie de l'expansion terrestre. *Sciences, Revue trimestrielle de l'AFAS*, n°91-(2-3, April), 18-29.

Hilgenberg, O.C., 1929: *Das Rätsel Gravitation gelöst (Solution to the mystery of gravitation)*. Published by the author, Kassel, pp.14.

Hilgenberg, O.C., 1931: *Über Gravitation, Tromben und Wellen in bewegten Medien (On gravitation, vortices and waves in moving bodies)*. Published by the author, Berlin, pp.78.

Hilgenberg, O.C., 1932: *Über Wirbelringnatur atmosphärischer Erscheinungen, insbesondere der Zyklonen, Antizyklonen und Böen (On the vortex nature of atmospheric phenomena, especially of cyclones, anticyclones and winds)*. Published by the author, Berlin, pp.14.

Hilgenberg, O.C., 1933: *Über den Magnus-effekts und seine Umkehrung (On inversion of the Magnus effect)*. Publ. by the author, Berlin-Charlottenburg, pp.28.

Hilgenberg, O.C., 1933: Über die Umkehrung des Magnuseffekts (On inversion of the magnus effect). *Z. Techn. Phys*, 14, 211-214.

Hilgenberg, O.C., 1933: *Vom wachsenden Erdball (The expanding Earth)*. Berlin, Giessmann & Bartsch, pp.56.

Hilgenberg, O.C., 1934: Vergleich der Längenzunahme der Meterprototypen mit der errechneten Zunahme des Erddurchmessers (Comparisons of the increase in the Meter prototypes with the calculated increase in the Earth's radius). *Gerlands Beitr. Geophys.*, Vienna, 42, 409-412.

Hilgenberg, O.C., 1938: Schollen-und Gebirgsbildung als isostatischer Vorgang (Formation of plates and mountains as an isostatic process). *Zeitschrift für Geomorphologie*, Bd. X (4/5), 121-136.

Hilgenberg, O.C., 1939: Über Beziehungen zwischen den Stellen maximaler Änderung der Sonnenflecken-Relativzahlen und den Maximumstellen geo- und astrophysikalischer Erscheinungen (On the relationship between the sunspot locations and geophysical and astrophysical phenomena). *Annalen der Hydrographie und Maritimen Meteorologie*, August 1939, 421-424.

Hilgenberg, O.C., 1939: *Über Strömungsversuche mit Senken und Quellen, die das Wesen der Schwerkraft grundlegend erklären (On flow experiments with holes and springs, which suffice to explain the nature of gravity)*. Publ. by the author, Berlin-Charlottenburg, pp.72.

Hilgenberg, O.C., 1940: Zur Frage der Trift der Kontinente und der Permanenz der Ozeane (On the necessity of continental drift and the permanency of the oceans). *Annalen der Hydrographie und Maritimen Meteorologie*, August 1940, Bd.68, 262-272.

Hilgenberg, O.C., 1949: *Die Bruchstruktur der Erdrinde, insbesondere von Grönland, verglichen mit dem Schwächenetz von spröden Prüfkörpern (The faulting structure of the Earth's crust, especially that of Greenland, compared with the sample-test weakness grid). Berlin Techn.* Univ. Diss. Fak. allgem. Wiss. 8.1.1948 (University-Degree Dissertation). Published under the title: *Die Bruchstruktur der sialischen Erdkruste*. Akad. Verlag, Leipzig-Berlin, pp.106.

Hilgenberg, O.C., 1951: Die Bruchstruktur von Antarktika (The Antarctica faulting system). *Polarforschung*, 3, 65-67.

Hilgenberg, O.C., 1953: Translation into German with supplements from the book by C.F. Krafft *The Ether and its Vortices*, Washington, publ. by the author, 1953, pp.66.- *Der Äther und seine Wirbel*, Berlin, Schikowski.

Hilgenberg, O.C., 1958: Die Bruchstruktur von Ungarn und seinen Nachbarländern, verglichen mit der Bruchstruktur der restlichen Sialkruste und bezogen auf die früheren Pollagen der Erde (The faulting structure of Hungary and neighbouring countries, compared with the faulting structure of the remaining sialic crust in reference to the ancient position of the Poles). *Geofizikai Közlemények*, 7, Budapest, 199-207.

Hilgenberg, O.C., 1959: *Quantenzahlen, Wirbelring-Atommodelle und Heliumsech-serring-Aufbauprinzip des Periodensystems der chemischen Elemente (Quantum Numbers, Atomistic Vortex Models and the Principal of the Hexagonal Structure of Helium in the Periodic System of the elements)*. Publ. by the author, Berlin-Charlottenburg, pp.36.

Hilgenberg, O.C., 1962: Rock Magnetism and the Earth's Palaeopoles. *Geofisica Pura e Applicata*, 53, 52-54.

Hilgenberg, O.C., 1962: Paläopollagen der Erde (Earth's palaeopoles). *N. Jb. Geol. Paläont. Abh.*, 116, (1), 1-56.

Hilgenberg, O.C., 1963:Earth Expansion, deep-sea trenches, and inclination of the shelf-sea floors. In: Proceedings of *Symposium on syntaphral tectonics and diagenesis* held in Hobarth, Tasmania, 20-25 May 1963.

Hilgenberg, O.C., 1965 :Die Paläogeographie der expandierenden Erde vom Karbon bis zum Tertiär nach paläomagnetischen Messungen (The Paleography of the expanding Earth from the Carboniferous to the Tertiary Period, according to paleomagnetic measurements), *Geologischen Rundschau*, 55, 878-924.

Hilgenberg, O.C., 1966: Bestätigung der Kennedy-Channel-Scherung durch die Bruchstruktur von Grönland und Nordost-Kanada (Confirmation of mega-shear in the 'Kennedy Channel,' caused by the Faulting Structure of Greenland and NE-Canada). *Geotekt. Forsch.*, 22, 1-74.

Hilgenberg, O.C., 1966: (Reconstruction of the continents for the Carboniferous, Permian, and Cretaceous, according to paleomagnetic measurements). *N. Jb. Geol. Paläont. Abh.*, 124 (3), 254- 258.

Hilgenberg, O.C., 1966: Earth expansion, deep-sea trenches, and the inclination of the shelf-sea floors. *N. Jb. Geol. Paläont. Mh.*, 6, 138-145.

Hilgenberg, O.C., 1966: Zur Frage der polnahen Lage von inland-vereisten Teilen Gondwana-Lands (On the Necessity for the Position near the Poles of the Frozen parts of Gondwana). N. Jb. Geol. Paläont. Mh., 7, 433-436.

Hilgenberg, O.C., *1967: Why Earth expansion?*. Published by the author, Berlin, pp.16.

Hilgenberg, O.C., 1967: *The red shift of the Sun's light in relation to the swallowing constant of the ether stream hypothesis*. Unpublished manuscript sent to Prof. S.K. Runcorn.

Hilgenberg, O.C., 1969: Der Einfluß des Maßes der Erdexpansion auf die Vererzung der Erdkruste und die Lage der Erdpole (The influence of the amount of expansion of the Earth on the metallogenesis of Earth's crust and the position of the Poles). *N. Jb. Geol. Paläont. Mh.*, 3, 146-159.

Hilgenberg, O.C., 1974: Geotektonik, neuartig gesehen (Geotectonics, seen in a new way). Geotektonische Forshungen, 45, 1-194.

Hilgenberg, O.C., 1976: *Erdentstehung und Entwicklung – Erdschrumpfung oder expansion?* (Formation and evolution of the Earth – Contraction or expansion?). Unpublished Manuscript. pp.57.

Hixon, H.W., 1920 : Is the Earth expanding or contracting? *Popular Astronomy*, 28 (5), 254-264.

Imeroni, A., 1927: Domenico Lovisato, la vita e le opere. *Mediterranea*, N°11-12, pp.42.

Keindl, J., 1940: *Dehnt sich die Erde aus? Eine geologische Studie*. Herold Verlag, München-Solln, pp.50.

Lindemann, B., 1927: *Kettengebirge kontinentale zerspaltung und erdexpansion*. Fischer, Jena, pp.186.

Mantovani, R., 1889: Les fractures de l'écorce terrestre et la théorie de Laplace. *Bull. Soc. Sc. et Arts Réunion*, 41-53.

Mantovani, R., 1909: L'Antarctide. *Je m'instruis. La science pour tous*, n°38, 19 sept., 595-597.

Mantovani, R., 1924: Les points de contact entre la théorie de la dilatation planétaire et la théorie de la dérive des continents. *C.R. somm. Soc. géol. France*, (4), XXIV, 167-168.

Mantovani, R., 1927: L'Atlantide et la découverte de la dilatation planétaire. *C.R. somm. Soc. géol. France*, (4), XXVII, 153-155.

Misc. Authors, 1859: *La création et ses mystères dévoilés. Premier recueil des observations critiques concernant cet ouvrage*. E. Voitelain and C., Paris, pp.48.

Muir Wood, R., 1985: *The dark side of the Earth*. Allen & Unwin, London, pp.246.

Owen, H.G., 1983b: *Atlas of continental displacement, 200 million years to the present*. Cambridge University Press, Cambridge, pp.159.

Pfeufer, J., 1981: *Die Gebirgsbildungsprozesse als Folge der Expansion der Erde*. Verlag Glückauf GmbH, Essen, pp.125.

Pfeufer, J., 1992: Zur Hypothese der Expansion der Erde. *Zeit.für Geolog. Wissenschaften*, 20 (5/6), 527-546.

Pfeufer, J., 1996: Oceanic structure seen by earth expansion hypothesis. *Theophrastus Contribution*, Vol. I, Athens, Greece, 75-85.

Pilla, L.,1847: *Trattato di Geologia*. Parte Prima. Tipografia Vannucchi, Pisa, pp.549

Placet, F.F., 1666: *La corruption du grand et petit monde. Où il est traité des changements funestes arrivés en tout l'univers et en la nature humaine depuis le péché d'Adam*. Alliot & Alliot, Paris, pp.367.

Sacco, F., 1906: *Le lois fondamentales de l'orogénie de la Terre*. Clausen & Rinck, Torino, pp.26.

Scalera, G., 1995: Terra in espansione. Article for the *Enciclopedia delle Scienze Fisiche*, vol.VI, Istituto per la Enciclopedia Italiana Treccani, Rome, 228-231.

Scalera, G., 1997: Un musicista scienziato a cavallo tra 800 e 900: Roberto Mantovani e la teoria della dilatazione planetaria. In Pasquale Tucci (ed.): *Atti del XVI Congresso di Storia della Fisica e dell'Astronomia*. Centro Volta, Villa Olmo, Como 24-25 May 1996. Tipogr. Editrice C. Nani, Lipomo, 625-642.

Scalera, G. 1998: Paleogeographical reconstructions compatible with Earth dilatation. Annali di Geofisica, 41 (5-6), 819-825.

Snider-Pellegrini, A., 1858: *La création et ses mystères dévoilés*. Frank e Dentu, Paris, pp.487.

Termier, P., 1922: *A la gloire de la Terre*. Chapter 'l'Atlantide' (p.117-146). Desclée De Brouwer et Cie, Paris, Huitième édition, pp. 425.

Turner, M.S., 2000: More than meets the eye. *The Sciences*, New York Academy of Sciences, Vol.40 n°6, Nov/Dec, 32-37.

Vogel, K. 1990: The expansion of the Earth - an alternative model to the plate tectonics theory. In: *Critical aspects of the plate tectonics theory*, Vol.II, Alternative theories. Theophrastus Publishers, Athens, Greece, 14-34.

Von Ihering, H., 1907: *Archhelenis und Archinotis, Gesammelte Beiträge zur Geschichte der Neotropischen Region*. W. Engelmann, Leipzig.

Wegener, A. 1912a: Die Entstehung der Kontinente. *Geol. Rundschau*, 3, 276-292.

Wegener, A. 1912b: Die Entstehung der Kontinente. *Petermanns Geog. Mitteilungen*, 58, 185-195, 253-256, 305-309.

Wegener, A. 1929: *Die Entstehung der Kontinente und Ozeane*. Fiedr. Vieweg & Sohn. Braunschweig. 4[a] ed. Italian translation by Clara Giua, Boringhieri, Torino, 1976, pp.313.

Yarkovski, J., 1888: Hypotèse cinétique de la gravitation universelle en connexion avec la formation des éléments chimiques. Chez l'Auteur, Moscow, pp.139.