

Press Release

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Recycling on Earth for more than 3 billion years Plate tectonics much older than previously thought

16 July 2019 / Grenoble / Kiel. Only 100 years ago Alfred Wegener developed the theory of continental drift. However, the associated recycling process of crustal material began much earlier than previously thought. An international team of scientists with the participation of the GEOMAR Helmholtz Centre for Ocean Research Kiel and Kiel University now presented evidence that this process started more than three billion years ago. The study was published in the international journal *Nature*.

The theory of plate tectonics was invented by Alfred Wegener only about 100 years ago but, apparently, it exists since the earliest geological history of our planet. Driven by convection in the Earth's interior, large pieces of the crust - so-called plates - are displaced on the viscous mantle. The worldwide recycling of the wet oceanic crust from the Earth's surface to the deep mantle and then back to the earth's surface is one of the main features of this plate tectonic regime which is to our present knowledge unique in the solar system. However, it was previously discussed controversially when this process started during the 4.5 billion years of earth history. An international research team with the participation of the GEOMAR Helmholtz Centre for Ocean Research Kiel and the Kiel University could now show that plate tectonic processes which recycled seawater back into the mantle existed more than three billion years ago.

"The evidence for our hypothesis is drawn from small inclusions in the mineral olivine in very old rocks that we have investigated geochemically", explains Dr. Maxim Portnyagin from GEOMAR, co-author of the study, which has now appeared in the renowned scientific journal *Nature*. The international team of researchers led by ISTERRE in Grenoble, France, investigated very small melt inclusions in the mineral olivine of komatiites from the Barberton Belt in South Africa, which are 3.3 billion years old. Komatiites originated from very hot magmas, which were mainly produced in the early geological history by an unusually high proportion of melted material from the mantle. They show similar geochemical signatures to previously analysed samples from Canada, but are 600 million years older. "The geochemical processes studied here are extremely complex and required the use of a number of sophisticated instruments such as electron microprobe or ion- and laserprobes with mass spectrometers which enabled us to analyse the smallest inclusions", Dr. Garbe-Schönberg from Kiel University explains, who was also involved in the study. "This was only possible in close cooperation with a number of institutions, since nobody has all these options", the geochemist continues.

According to the findings of the scientists, 3.3 billion years ago the Earth mantle had already been modified by recycling of wet crustal material. "So crust recycling is a very old story and has shaped our planet for billions of years", Dr. Portnyagin concludes.

Reference:

Sobolev, A. V., Asafov, E. V., Gurenko, A. A., Arndt, N. T., Batanova, V. G., Portnyagin, M. V., Garbe-Schönberg, D., Wilson, A. & Byerly, G. R., 2019: Deep hydrous mantle reservoir provides

evidence for crustal recycling before 3.3 billion years ago. *Nature*, **571**, doi: 10.1038/s41586-019-1399-5.

Links:

www.geomar.de GEOMAR Helmholtz Centre for Ocean Research Kiel

Images:

At www.geomar.de/n6614 images are available for download.

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