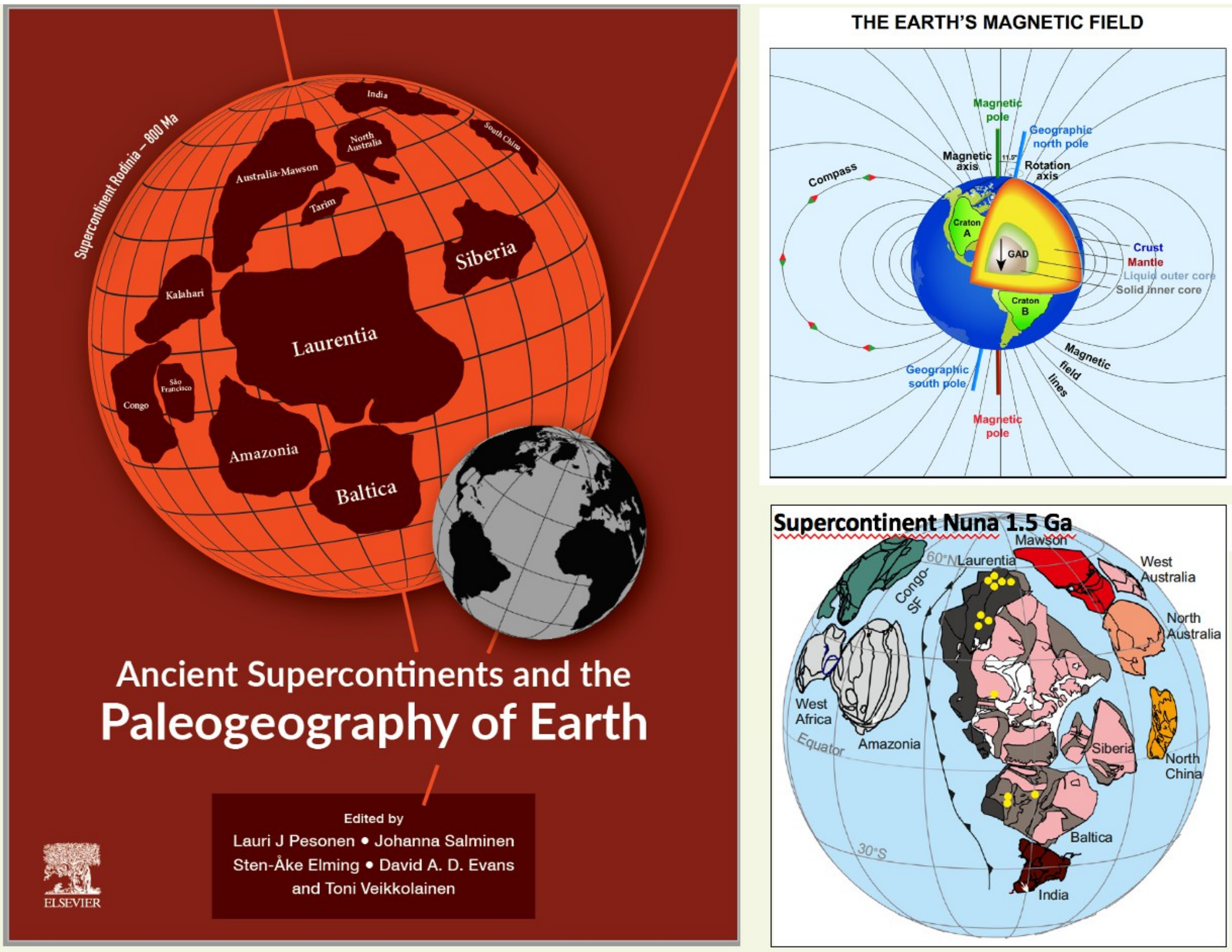
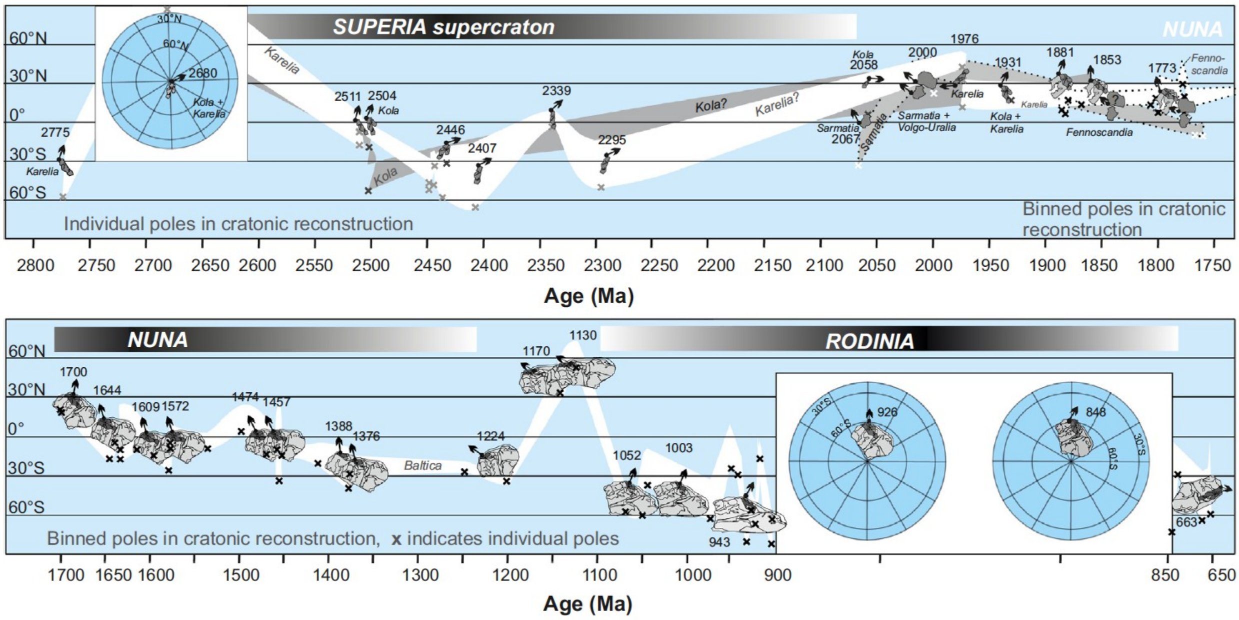
A novel geoscience book ***"Ancient Supercontinents and the Paleogeography of Earth"*** has been recently (Oct.15, 2021) published by Elsevier Co. The editors are Lauri J. Pesonen, University of Helsinki; Johanna Salminen, University of Helsinki and the Geological Survey of Finland; Sten-Åke Elming, Luleå University of Technology, David Evans,Yale University and Toni Veikkolainen, University of Helsinki).



Left the front cover of the new book. Upper right, the used Earth´s magnetic dipole field model (adopted from Chapter 3); lower righ: the Supercontinent Nuna at 1.5 Ga ago (from Chapter 16).

The book provides a new view of the drift of the continents following Alfred Wegener´s original idea from 1915 –but in a revised form and extending the concept back to Precambrian times. The histories of the drifting continents have been calculated using the most reliable paleomagnetic data as compiled in international databases, coupled with new geophysical, geochronological and geological data. The drift histories of the continents are shown in a series of high-quality colored images. The highlight of the book is the result showing the continents have been on a “collisional course” several times in the past 3 billion years and they amalgamated into supercontinents at least three times during their geological past: Nuna assembly 1.7-1.3 billion years ago, Rodinia 1.0-0.6 billion years ago and Gondwana/Pangea landmass ca. 0.5-0.18 billion years ago. Another new output of the book is that the story of the birth and evolution of continents has taken place through various stages: starting from the rocky embryos during the Hadean times, when magma ocean tectonism was in operation, followed by the growth of continental proto-cratons (the primordial nuclei of continents) during the Hadean-early Archean era under lid-tectonism. The proto-cratons began to form separate larger cratons, which, during the course of late Archean-early Paleoproterozoic times, collided and formed supercratons. The tectonic style was proto-plate tectonics and involved, at a first time, subduction of crustal slabs into the mantle. Since about Middle-Paleoproterozoic times ca. 2.5 billion years ago, the modern *plate tectonics* became a dominant operational process giving rise to the *supercontinent cycle* on planet Earth.

Who were our geological neighbors? The current world map shows that the six continents are dispersed from each other, and thus do not form a supercontinent. The geological explanation is that the continents have recently been dispersed from the “ancient” supercontinent Pangea since it broak up about 180 million years ago, and they are on the way towards the next (yet hypothetical) supercontinent Amasia. Taking Baltica as an example, it consists of the primordial continental cratons, Kola, Karelia, Sarmatia and Volgo-Uralia. These cratons drifted independently during the Archean-Paleoproterozoic time and amalgamated into a continent, which we call “Baltica”, at ca. 1.7 billion years ago.



This figure outlines the latitudinal drift histories of Kola, Karelia, Sarmatia and Volgo-Uralia cratons during the Archean-Paleoproterozoic times and their collision and amalgamation into the continent Baltica at ca. 1.7 Ga ago. (from Chapter 5 of the book).

During the 3 billion years journey the Baltica´s cratons have, from time to time, collided with other continents to form supercontinents. Baltica's geological neighbors, after its consolidation in ca. 1.7 Ga, have been, for example Laurentia (the geological core of North America), Siberia, India, Amazonia, Congo, West Africa, and China. They appear in various geographical and continental configurations in the supercratons mentioned above. During the magnificent voyage on the globe, Baltica - its cratonic pieces in one hand, and Baltica as a unity in other hand - has also geologically grown from a rocky embryo to a continental nucleus and to its present size of continent. During the track, the crust of the bedrock of Baltica has also thickened, reaching now a thickness of 40-60 km.

Supercontinents appear in cycles. There are several *scientific breakthroughs* in the book. One such is the concept that supercontinents are born in cycles of about 500 million years. This idea is supported by the similar cyclicity seen in geophysical, geochemical and geochronological data of bedrock samples from all continents. It appears that the causes and expected effects of the fundamental forces driving the continents to move on the Earth´s surface are linked together and cover all eight spheres of Earth: from the core to the lower mantle, up to the asthenosphere and lithosphere, and to hydrosphere, biosphere, atmosphere and magnetosphere. Another new idea of the book is that the spheres interact with each other during the supercontinent cycle. The forces behind the drifting continents are part of the *plate tectonics* theory developed in late 1960´s and which has been used to explain today´s geological and tectonic processes on Earth. In light of the new book, it appears that *plate tectonics* has been operative for more than 2 billion years extending the previous thought of its onset age by some 1.5 billion years back in time.

Unlike in previous works, in the new book the continental motions and paleogeographical reconstructions have been calculated using paleomagnetic data as derived from rock samples as a prime scientific technique. This method takes advantage of the memory of the Earth's magnetic field left in the minerals of the crust - in other words, the rocks act as "magnetic fossils" that can be used to delineate the ancient latitudes and orientations of the continents. Two necessary conditions must be valid in using this method; the first one is that the Earth´s magnetic field has always been like a huge bar magnet ("GAD", geocentric axial dipole) located at the center of the Earth (see Figure) and second, that the minerals can be dated with radiometric (isotopic) methods. Both conditions are applicable to the past 3 billion years. The series of supercontinent reconstructions presented in the new book have thus been made using paleomagnetism together with geological, geophysical and geochronological data and applying spherical Euler-geometry on the Earth´s surface and using proper spherical projections. These supercontinent models override previous ones, which have often been made using cartoons without proper co-ordinate systems.

Furthermore, the drift of continents across latitudes from the Equator to the poles has further been tested using information provided by climatically sensitive sediments. These include e.g. evaporites (salt deposits), which hint that the continents have been located near the Equator, or glaciogenic rocks, which, in turn, refer to near polar latitudinal positions The results turned up to bring a surprise: during certain eras (e.g. 2.4-2.1 and 0.65-0.54 billion years ago), glaciations have been found on many continents lying near equatorial latitudes. Several explanations are presented for this dilemma, one of which is the so-called “Snowball Earth”-theory, where the entire globe was covered in ice during these eras. This intensively debated issue is one of the unsolved mysteries discussed in the chapter dealing with “remaining problems and future topics”. We hope these unsolved problems encourage young researchers to tackle them.