

Problem outline

Mountain belts – orogens – such as Alps, Himalaya, or Andes, develop as a result of complex mountain-building processes. A primary cause are mutual collisions of steadily moving lithospheric plates. Persistent motion of these plates, which is known as a continental drift, has been in a global operation since more than 3 billion years, since the Archean. No wonder that from time to time some plates expose to collision the same continental edges which already did collide in the past, formed a new continent and then broke-up and separated again. As a result one can observe a sequential growth of continents as new orogenic belts add to the old ones. In Europe, the Alpine belt (100–25 Ma) was accreted to the older Variscan belt (380–300 Ma), and the Variscan belt was amalgamated with the Cadomian belt (650–540 Ma). The Variscan Orogen developed owing to the collision of two ancient continents: Baltica and Gondwana. An inner part of the Variscan belt is composed of microcontinents which in Neoproterozoic and Early Paleozoic times occurred at the NW margin a peripheral orogen referred to as the Avalonian-Cadomian belt. It was presumably similar to recent Andes or Cordilleran mountain belt in both Americas. The marginally located Avalonian-Cadomian orogeny (ACO), along with magmatic arcs incorporated into it, jointly developed what is known as peri-Gondwana. In the course of collision between Baltica and Gondwana, a number of peri-Gondwana fragments were built into the Variscan orogen and became obliterated by subsequent events. In order to learn the history peri-Gondwana, an ancestor of the Variscides, it is necessary to identify and then study such old foundations of the Variscan Orogen. Processes that led to the development of the peripheral Avalonian-Cadomian belt are still poorly known. In Europe, they have been relatively well studied in Armorica, significantly less in other regions. Therefore this project is aimed at broadening our knowledge about the internal architecture of peri-Gondwana, origin and provenance of its individual segments, their mutual relationships as well as the evolution of the ACO, paleogeographic position and the pre-Variscan events that took place at 650–540 Ma (Ediacaran–Ordovician) in those fragments of peri-Gondwana, which later became incorporated in the Variscan orogenic edifice. An objective planned to be studied in this project are mainly those relics of ACO which are embraced by the central European Variscides: northern part of the Bohemian Massif (from NE Bavaria to Silesia), the adjacent terrane of Brunovistulia and Małopolska.

Working hypothesis

The research is designed in order to: (1) reveal as fully as possible, complex characteristics of these elements, (2) precise their still discussed and controversially interpreted original location in peri-Gondwana, (3) reconstruct igneous, metamorphic and tectonic processes that controlled evolution of these elements in the peripheral ACO until they became separated from Gondwana mainland by rifting which was followed by drift toward Laurussia.

A working hypothesis assumes that the Variscan orogen in the Sudetes and adjacent areas incorporated those fragments of peri-Gondwana that in the Ediacaran–Ordovician occurred next to the Arabian-Nubian segment of the Gondwana mainland. A subducted portion of an accretionary prism and deeper portions of the magmatic arc were subjected diachronically to tectonic shortening, metamorphism and anatexis melting that yielded S-type granitoid magma. In shallower level of the arc, basinal sedimentation and bimodal volcanism went on. Shortening of the crust led to tectonization of the infill of the existing basins, opening of new ones and renewed fragmentation of peri-Gondwana. Presumably, the earliest tectonic deformations observed in some Lower Palaeozoic rocks in the Variscan belt and assigned to a poorly constrained Variscan D1 event, actually took place in the Cambrian–Ordovician and actually were the continuation of the Cadomian event. In southern Poland, the Cadomian basement was built-in the Sudetes, the Upper Silesia (part of the terrane of Brunovistulia) the Małopolska massif, yet the latter two were palaeogeographically located in peri-Gondwana differently than the Sudetic domains and originally they did not make a uniform continental fragment.

Planned research

Studies that are to be undertaken in this project, will be targeted on the three research problems mentioned above. The detailed investigations will be aimed at: (1) refining or determining age and provenance of metasedimentary rocks as well as approximate reconstruction of the frames of the sedimentary basins, (2) determining a geotectonic position of the individual peri-Gondwana fragments under investigations in Ediacaran-Ordovician times; (3) determining origin and evolution of bimodal igneous rocks, age of their protoliths, and isotopic age of metamorphism (wherever possible) or relative age by reference to the age of veins of igneous rocks that the metamorphosed rocks; (4) deciphering types and succession of tectonic deformations in metasedimentary and other metamorphic rocks; (5) determining geotectonic regime(s) and changeable position of lithotectonic units with time; (6) determining directions of primary magnetization for the selected rocks with the satisfactorily established tectonic history; (7) determining paleogeographic position of the selected rock associations.