

Palaeoenvironmental records and causes of the global Kačák Episode in the late Eifelian (Middle Devonian)

DESCRIPTION FOR THE GENERAL PUBLIC

The history of the Earth and its biosphere is punctuated by short episodes of anomalous environmental conditions - geological events caused by exceptional phenomena such as large bolide impact or exceptionally strong and widespread volcanism. One of significant events during the last half billion years of the Earth's history, termed the Kačák Episode or Event, took place ca. 390 mln years ago in the Middle Devonian, close to the Eifelian-Givetian stages boundary. The sediments attributed to this event are commonly dark shales formed during conditions of deepened sea and weak oxygenation of marine waters. The event, characterized by significant changes in organic world, including extinction of certain organisms, has not been satisfactorily recognized yet, and its nature and causes remain unclear.

The aim of the project is to elucidate the environmental background and causes of the Kačák Episode based on detailed studies of the sediments from various regions of the world. Apart from Poland, the investigations will cover sedimentary successions from Czechia, Germany, Belarus, France and Morocco. They represent different palaeogeographic zones, which will guarantee that the studied records of the Kačák Episode will be diverse as well. This will allow to investigate various aspects of the event - sedimentary, geochemical, geophysical and biotic. A comparison of global records of these attributes will be possible owing to application of precise tools of age correlation. These will be provided by marine microfossils - conodonts, being very accurate age indicators in the Middle Devonian, due to their rapid evolution.

The first stage of **investigations** will comprise collecting observations and study materials in the field - description of field exposures, geophysical measurements of magnetic and radioactive properties of sediments, and collecting rock samples for laboratory analyses. The latter will include detailed description of microscopic features of rocks visible in thin sections, and related to conditions of sediment accumulation. Main and trace (mainly metals) elemental analyses will allow to determine a terrigenous admixture, degree of oxygenation of the marine environment and its organic productivity. Investigations of stable oxygen and carbon isotopes will give valuable informations on a seawater chemistry and potential global anomalies. Of particular importance will be results of neodymium-samarium isotopes indicating sealevel changes, and oxygen isotopes in apatite - a mineral forming conodont elements. The latter analyses will allow to estimate surface seawater temperatures, and thus determine climate changes.

The main **reason for undertaking the described studies** is a lack of satisfactory explanation of causes of the Kačák Episode despite its wide global occurrence and its significant influence on a development of sedimentation and biota in the Devonian, or even in the whole Palaeozoic. The episode belongs to several similar "black-shale events" with apparent interrelated global transgression and low-oxygen regime, but without associated mass extinction similar in scale to e.g. the famous Kellwasser Event in the Late Devonian. The causes of the transgression remain unexplained, while possible controls by astronomically-driven climatic factors (e.g. leading to waxing and waning of continental glaciation) remain hypothetical. Possible influence of widespread magmatism, recently documented for all major mass-extinctions in the last 500 mln years, has not been proven as well. The investigations planned within the project framework will allow to verify the mentioned and other hypotheses, thus contributing to explanation of phenomena that took place on the Earth about 390 mln years ago.