Earth's lithospheric mantle, together with above lying continental and oceanic crust form rigid and cool structure called lithosphere. Lithosphere is floating on a plastic, hot asthenosphere. Astheno- and lithosphere react with each other and exchange chemical components and heat, which leads to lithosphere melting. Lithosphere melting forms basaltic magmas which may reach Earth's surface and form volcanoes. On its way up, basaltic magma pulls out pieces of surrounding lithospheric mantle and lower regions of crust and carries it to Earth's surface. Those small pieces (few cm in diameter), called xenoliths, and accompanying large crystals (megacrysts) constitute the only source of direct information about composition of deep parts of our planet.

Information about European upper mantle rocks older than Variscan are available only from northern part of the continent. Xenoliths and megacrysts sampling Archaic (2.5 Ga) upper mantle and lower crust are known from northern part of Scotland (United Kingdom) and southern Sweden (Scania region), while in central Scotland xenoliths of Caledonian age (Early Palaeozoic) occur.

The available literature data on petrology and geochemistry of xenoliths of upper mantle rocks from southern Sweden and northern and southern Scotland are scarce, cursory, often reduced to chemical analyses of 2-3 samples. In some of the studies basic geochemical information is lacking, e.g. content of trace elements. Those data are insufficient to reconstruct the structure and evolution of upper mantle in pre-Variscan Europe. Therefore, a detailed chemical examinations on xenoliths and megacrysts from Scotland and Sweden will be conducted. The major questions we are seek to answer are: 1) what is the degree of lateral continuity between different areas of Archean mantle beneath northern Scotland and Sweden? (2) What is the lateral continuity of Caledonian mantle beneath southern Scotland? And (3) are there systematic differences in the metal budget of the two key end-member lithologies in the mantle – peridotites and pyroxenites – and what does this mean for the metallogeny of subduction-related and orogenic tectono-magmatic regimes globally?

In our studies we will use peridotitic and pyroxenitic xenoliths and megacrysts of feldspar, biotite and pyroxene from three sampling sites: 1) from Cainozoic lamprophyre from Loch Roag (Outer Hebrides, N Scotland); 2) from Palaeozoic (Permo-Carboniferous) mafic alkaline volcanic rock from Midland Valley and Southern Upland regions (Scotland); 3) Mesozoic (Jurassic) volcanic rocks from Scania (S Scotland). The selection of Midland Valley and Southern Upland regions as a place where Caledonian mantle will be studied was dictated by a fact, that mantle xenoliths from those regions have never a topic of a systematic studies. In our studies an archival material from British Geological Survey and University of Lund will be used, but field works in south west Scotland and in Scania will be proceeded as well. Studies on xenoliths and megacrysts will include microscale, *in situ* investigations on trace and major element chemical composition of silicate phases. In bigger samples also bulk rock chemical composition and Nd-Sr isotopic ratios will be established. The chemical features of silicates will allow us to establish the evolution of lithospheric mantle (temperature of crystallization of minerals, degree of melting and metasomatic history) in every of the studied locality and further compare evolution of: 1)Archean mantle from Scotland and Sweden; 2) Caledonian mantle from east and west part of Midland Valley and Southern Uplands, and 3) mantle underlying southern and northern Scotland.

We assume, that around 40 from 140 studied samples will be characterized by high contents of sulphide phases. The sulfur system in the mantle records different processes than the silicate one, and therefore silicates and sulphides constitute a source of complementary information. The sulphides will be studied in terms of their occurrence and chemical composition including precious metals (PGE, gold). The achieved data will allow us to establish the content of sulphides in different types of mantle rocks coming from different geotectonic settings. This information may contribute to the emergence of new methods of seeking of metal deposits.

This project will be the first in Europe holistic study on evolution of silicate and suphide systems in Archaic and Caledonian lithospheric mantle. It will be based on cooperation between specialist in mantle petrology from: Poland (responsible for studies on silicate systems), Great Britain (responsible for studies on sulphide systems), and France and Austria, who will share their highly specialized analytical equipment. In the frame of the project four to six scientific articles will be published and two to three master thesis will be prepared.