The arrangement of oceans and continents on Earth is a result of plate tectonics. Through geological time the motions of tectonic plates have shifted the continents around the Earth. Oceans have opened then closed again and continents have collided with each other to build mountain ranges. A map of the Earth in, say, the Ordovician geological period looks very different to our modern world. Our proposed research will investigate the geography of a long-vanished ancient ocean, "Iapetus". We will try to understand the tectonic processes that led to the ocean's closure, the building of a great mountain range (the "Caledonian mountain belt"), and the addition of new rock to the continents of Baltica (modern Northern Europe) and Laurentia (modern North America and Greenland) on either side of Iapetus. The addition of this new rock has contributed to the growth of these continents and is an example of the way in which continents have grown over time – a process known as "accretion", which is occurring along the Pacific coast of south America today.

New rock is generated within ocean basins along chains of volcanic islands called "island arcs". These are located at deep ocean trenches where the edge of an oceanic plate is sinking into the Earth's interior, a process called "subduction". Rocks above the subducting plate melt and produce magma, which erupts at volcanoes and congeals below the surface to make igneous intrusions. If a subduction zone migrates across an ocean, it will draw the island arc along with it. The crust behind the arc may be stretched and open a basin that will accumulate sediment and have volcanic activity. Eventually the island arc will collide with a continental margin and be added to the continent. At this point subduction may re-initiate at the continental margin where a new volcanic chain will form, adding more igneous rock to the continent. All these processes cause changes in the temperature of rocks. Where they are heated new minerals will form in them. Geologists call this "metamorphism". Subduction and magma motion at island arcs create distinctive metamorphic rocks. Minerals in these rocks can be analysed for their chemistry and isotope composition to yield the temperature and depth at which they formed and, importantly, the time of their formation.

Evidence for subduction and accretion can be found along a large swathe of the Caledonian mountain belt in Scandinavia in rocks of the Köli Nappe Complex, formed mainly in the Ordovician Period about 490 to 440 million years ago. It is thought that they formed at island arcs in the Iapetus Ocean, collided and accreted to Laurentia and perhaps Baltica, and were eventually caught up in the collision of these two continents. We wish to study the metamorphic rocks of the Köli Nappe Complex, particularly in the remote and mountain scenery of Norrbotten in northern Sweden where these rocks are less well understood than elsewhere but have the potential to shed new light on Iapetus plate tectonics, and the processes of accretion and continental growth in general.