The Earth's continents are unique in the Solar System – a product of a water-rich planet in which the process of plate tectonics generates thick, buoyant slabs of strong, stable crust whose surface is sustained mainly above the global sea level. The rocks of the continents are commonly produced at subduction zones where the thinner, denser oceanic crust sinks back into the Earth's interior. The process is manifested by chains of volcanoes, known as "volcanic island arcs" that line the subduction zones. These show that the rocks of the subducting crust and adjacent mantle have been partially melted and the resulting magma has migrated to the surface to make igneous rocks. The continents have reached their present sizes by successive additions of arc rocks to their edges, a process called *accretion*. This has commonly happened when all the oceanic crust flooring an ocean basin has been consumed by subduction and the continental mass behind it collides with the arc. The final stages of such a process are now taking place as Australia moves closer to Southeast Asia colliding with the large volcanic islands in between. Accretion adds not only the arc rocks to the continent, but also sediments and igneous rocks that accumulated in the fore-arc and back-arc regions.

Many studies of continental growth and modification have focused on the major phase of growth that happened in the early history of the Earth when the ancient cores of the continents ("cratons") were formed, but a major goal of our proposed study is to investigate an important, but little-recognised example of more recent (Phanerozoic – since 540 million years ago) continental growth in a subduction-collision system – the Caledonian mountain belt of Scandinavia. Here, crust generated in volcanic arc systems within the ancient Iapetus Ocean has been accreted to the Baltic craton by a combination of arc collisions and final continental collision with the continent of Laurentia. The accreted rocks are now preserved in the Köli Nappe Complex (KNC) in Sweden and Norway.

The Iapetus ocean reached its maximum size c. 500 million years ago and was at least as large as the modern Atlantic. The formation of subduction zones then caused narrowing of this ocean basin and led, ultimately, to its closure. The subduction zones lay within the ocean as chains of volcanic islands remote from the continents but later these collided, accreting the arcs to the craton edges. At this time subduction may have shifted to the edges of the continents, building volcanic chains similar to the modern Andes of South America. Then, c. 430 million years ago, Iapetus closed and the two continents bounding it, Baltica (todays northern Europe) and Laurentia (todays North America and Greenland) collided forming the huge Caledonian mountain range. This sequence of arc formation, accretion and collision was an important episode of continental growth, but we currently do not have a comprehensive and coherent understanding of it.

Relics of Iapetus ocean rocks such as those in the Köli Nappe Complex are superbly exposed and easily accessible along most of the >1500 km length of western Scandinavia. Igneous and sedimentary rocks typical of oceanic environments are well known in the KNC. Hence this region makes an excellent natural laboratory upon which to study the origins of oceanic rocks that have accreted to a continental margin. However, geochemical studies that are used to "fingerprint" the plate tectonic environment of the igneous rocks in the KNC were mainly undertaken nearly 40 years ago, there have been few sophisticated modern laboratory studies that can provide more details of the origins of the igneous rocks and the processes that generated them. Likewise, the isotopic dating methods used to find the age of the igneous rocks have become a lot more precise and better able to geochemically fingerprint rocks. The core aim of our proposed investigation is, therefore, to apply such methods in a systematic way in order to determine the origins of the oceanic terranes and the time-sequence of their evolution and accretion.

In order to trace the history of the growth of Baltica, we will try to answer the following questions: What was the Iapetus ocean like before the collision of Baltica and Laurentia? What can the KNC rocks tell us about the processes within the Earth by which they originated and interacted with the continents? Do the rocks represent island arcs? Volcanic chains on the borders of continents? Fragments of continents? When were they created? To answer these questions we will mainly focus on the igneous rocks, which are the primary type of rock material contributing to crustal growth.

The first step of our planned activities will be field research in the Scandinavia to collect rock samples for analysis. One key method is the chemical and isotopic analysis in the robust mineral zircon. By using modern methods for analysing microscopic amounts of this mineral, for example by laser ablation techniques, we can obtain accurate age estimates of igneous rocks and measure their trace element composition and the isotopic signatures of Hafnium and Oxygen. Such data would be essential evidence for identifying the source of magma in volcanic arcs and will, consequently, allow us to reconstruct of continental crustal growth.

We expect the outcome to be a more complete picture of the tectonic processes leading to the formation and accretion of new continental crust in one of the Earth's major ancient subduction-collision systems. Therefore, we will make a significant contribution to understanding continental growth in the Phanerozoic world and to the formation of its great mountain ranges.