The island of Sardinia, centre Mediterranean, during the Miocene-Oligocene, was an active continental magmatic arc, due the subduction of the Ionian Tethys towards North- West beneath the Sardinian crust. With a calc-alkaline affinity, lavas flows and domes have a wide range in therms of major elements, with lithologies spanning from basalts to dacitesryholites, outcropping in the North-Western side of Sardinia. Trace element composition of primitive basalts have typical Nb, Sr and Pb anomaly, with flat HREE pattern, consistent with a mantle source enriched by slab component. Calculations demonstrate that addition of sediments melts and MORB fluids, extracted by the subducting slab, to a peridotitic mantle with DMM composition, can generate partial melts with the required trace elements composition of the most primitive basalts. Moreover, radiogenic isotopes compositions of this enriched mantle explain the isotopic composition of primitive basalts, and addition of crustal material by assimilation in the crust, match the isotopic composition of evolved calc-alkaline lavas. More recently, during the Pliocene-Pleistocene, intra-plate volcanism produced alkaline basanites and hawaiites, with larger amount of more evolved alkaline rocks, outcropping mainly in the same locality of the previous calc-alkaline volcanism. Different petrogenetic models for the mantle source of this alkaline volcanism exist, as the presence of a mantle plume or ancient lithospheric metasomatism, but generally they are completed decoupled from the previous subduction-related volcanism. Here I propose an alternative petrogenetic model, where the evolution of the calc-alkaline magmatic system create the source for the alkaline volcanism. Based on experiments of fractional crystallisation in a calc-alkaline system, I modelled the trace elements compositions of different ultramafic cumulates forming olivine-pyroxene, garnet-pyroxene and amphibole-rich lithologies in the upper lithospheric mantle, that could be formed beneath the Sardinian arc during the subduction-related volcanism. These produced cumulates share similarity with the
natural pargasites in Sardinian calc-alkaline rocks, and the amphibole-clinopyroxene veins present in different alkaline settings, which can play a key role in the formation of oceanic and continental alkaline rocks. The presence within the same region of calc-alkaline and alkaline volcanic activity, was the main idea to investigate if calc-alkaline amphiboles could reproduce the geochemical characteristic of alkaline lavas, characterised by high values of incompatible elements content. In a relatively simple trace element model, I demonstrate that high degree partial melting of the modelled amphibole-clinopyroxene cumulates can generate melts with comparable trace elements content of the most primitive alkaline rocks. The presence in alkaline rocks of atypical clinopyroxene, having a composition more akin to the clinopyroxene of the previous calc-alkaline system, suggest that a link between the two types of Cenozoic volcanisms could exist. The results of this research provide a new alternative mechanism suggesting a petrogenetic link between the formation of calc-alkaline ultramafic cumulates, their detachment in the lithospheric mantle, and the presence of alkaline rocks in Sardinia representing melts of calc-alkaline hydrous cumulates.