Chemical weathering indicators at Archean–Proterozoic transition in the Pechenga, Imandra-Varzuga Greenstone Belts and Onega Basin

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Oxygenation of the atmosphere ca 2.3 Ga ago principally changed the redox state of the Earths near-surface environments. Oxidation possibly intensified the weathering of rocks exposed on continents and caused the increased mobility of different species dissolved under oxidative attack. Particularly, the oxidative weathering of sulphide minerals resulting in sulphuric acid as the by-product of oxidation has been viewed as a driver of strong acidic weathering, and causing delivery of sulphate into the oceans. The oxidation of atmosphere caused change in continental weathering style which resulted in build-up of sulphate reservoir and dawn of phosphogenesis being also accompanied by large perturbations in global carbon cycle, namely the Lomagundi positive carbon excursion.

In this contribution we study the weathering indicators in the FAR DEEP project rock record obtained from Petchenga and Imandra-Varzuga Greenstone Belt, and Onega Basin sequences that expose the transition from a largely anoxic to an oxidised atmosphere, and also reveal other major changes as the Lomagundi isotopically heavy $\delta^{13}C$ event and appearance of the first phosphorites. The paleoweathering surfaces and shale units penetrated by FAR DEEP drillholes provide an opportunity to document the influence of an oxic atmosphere on weathering processes.

The values of Chemical Index of Alteration minus potassium (CIA-K) of weathered mafic volcanics and shale units corrected for evident K-metasomatic alteration and authigenic carbonate minerals show values reaching >90 both in the uppermost parts of the weathered units and in shales indicating strong and deep weathering. Moreover, the intensified weathering during the onset of the Proterozoic and particularly the Lomagundi excursion is evidenced by abundant sandstone-siltstone units deposited in this time interval that are typically supermature quartz arenites indicating complete destruction of other rock forming minerals that would be a achieved only by strong chemical weathering.