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Geothermal research on the 2.5 km deep COSC-1 drillhole, Central Sweden

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The scientific drilling project “Collisional Orogeny in the Scandinavian Caledonides” (COSC), supported by ICDP and the Swedish Research Council, involves the drilling of two boreholes through carefully selected sections of the Paleozoic Caledonian orogen in Central Sweden. COSC-1, the first of the two planned boreholes, was drilled and fully cored down to 2.5 km depth during spring and summer 2014 near the town of Åre. The COSC working group is organised around six thematic teams including us, the geothermal team. The major objectives of the COSC geothermal team are: a) to contribute to basic knowledge about the thermal regime of Palaeozoic orogenic belts, ancient shield areas and high heat-producing plutons; b) to refine knowledge on climate change at high latitudes (i.e. Scandinavia), including historical global changes, recent palaeoclimate development (since last ice age) and expected future trends; c) to determine the vertical variation of the geothermal gradient, heat flow and thermal properties down to 2.5 km, and to determine the required corrections for shallow (< 1 km) heat flow data; d) to explore the geothermal potential of the Åre-Järpen area; e) to explore to what degree the conductive heat transfer is affected by groundwater flow in the uppermost crust and f) to evaluate the heat generation input and impact from the basement and the alum shales. To reach these targets the following tasks were carried out or are planned: 1) heat flow predictions from shallow boreholes; 2) geophysical logging; 3) analyses of logs and well tests; (3) determination of rock thermal properties on core samples; 4) determination of heat generation rates from radiometric and geochemical studies; 5) fracture characterisation for permeability and convective heat flow estimations; 6) analysis of convective signals; 7) analysis of paleoclimatic signals; 8) heat flow modelling and evaluation of geothermal potential and 9) Fennoscandia heat flow map compilation. The purpose of the present contribution is to summarise the tasks completed so far and to present the on-going research by the COSC geothermal team.