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Fifty Year Evolution of Thermal Manifestations at Surtsey Volcano, 1968 - 2018

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The Surtsey tephra, which formed between November 14 1963 and April 1964 in the phreatomagmatic phase of the Surtsey eruption, showed the first signs of palagonitization in 1969. The process of palagonitization in Surtsey is connected to the formation of a hydrothermal anomaly, first detected on the surface of the tephra pile in 1968.

The process of palagonitization is first inferred to have proceeded from 100 °C down to at least 40 °C in the uppermost 0.5 - 2 m of the tephra pile by the late Sveinn P. Jakobsson who did the first observations and continued to document this alteration of the basaltic glass for more than four decades. In the study reported here, all available published as well as a wealth of unpublished data by Sveinn P. Jakobsson on the surface manifestations of geothermal activity and measurements in the 181 m - drillhole that was completed in 1979, are compiled to give a comprehensive account of the evolution of the geothermal area in Surtsey during the period of 1968 - 2018. This includes data from maps showing the changing extent of both the geothermal area and the palagonitized area over time, maps and aerial photos showing the distribution of steaming fissures in palagonite tuff, as well as temperature measurements in tephra, lava and steaming fissures. The data is presented using GIS - software and the surface and drillhole data is integrated as series of maps and diagrams detailing the thermal history of Surtsey and the extent of the geothermal area and the palagonitized area over time.

Preliminary results of the analyzed data from the 1979 drillhole placed the maximum temperature of the geothermal system at about 100 m depth with values that measured up to 141.3 °C in 1980 and which are steadily decreasing down to 123 °C in 2018. The surface temperature measurements have shown a gradual migration of thermal manifestations from the eastern to the western tephra ring and even though a general decline in the temperature within the thermal area can be observed, modern surficial temperatures still measure over 100 °C in specific localities.