Long-period earthquakes recorded on a dense seismic array during the 2014 Bárðarbunga rifting event

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Crustal accretion along the divergent plate boundary in Iceland is governed by rifting episodes and dyking. Over a period of two weeks in August-September 2014, magma propagated laterally from the subglacial Bárðarbunga central volcano, Iceland, about 50 km along the divergent plate boundary to the NNE where it erupted continuously for six months. The dyke propagation was associated with more than 30,000 earthquakes at 5–7 km depth, advancing in short bursts at 0.3–4.7 km/h. Following each surge forward, the seismicity behind the dyke tip dropped, implying that the subsequent dyke opening was mostly aseismic. More detailed analyses of the seismic data recorded by a dense network around the Vatnajökull icecap have revealed small magnitude, long-period (LP or B-type) events which in some cases coincide with an increase in continuous tremor. Most of the LP events originate at shallow depths NNE of the edge of the icecap beneath a 1000 m wide and 5 km long graben, which formed and subsided up to 8 m during the initial phase of the Holuhraun eruption. Furthermore, shallow LP events are also observed in the subglacial part of the dyke trajectory, under three distinct cauldrons. The LP events lie within the 0.5-8 Hz band and are too small to be detected by the national network of the Icelandic Meteorological Office (i.e. less than ML=1-1.5). The LP events are most likely associated with surface ruptures caused by magma moving vertically from the laterally propagating dyke.