Geology and geophysics of a Proterozoic mafic sill, Cape St Francis, Newfoundland

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In the northeast Avalon of Newfoundland, near the tip of Cape St Francis, is a prominent ENE-trending ridge about 600 m long and up to 85 m in elevation above its surroundings. As well as being a distinct topographic feature, the ridge also shows up as a positive anomaly in regional magnetic maps. The ridge owes its existence to the presence of a tilted mafic sill within more easily eroded sandstones and siltstones, and a protective cap of basalt flows. The sill is exposed in a steep scarp on the south side of east part of the ridge: further to the west it is not exposed. The Neoproterozoic rocks in this area are well preserved, showing only minor alteration and some faulting. There are three main mafic igneous units: fine-grained basalt occurring as pillows and thin flows; basalt containing plagioclase phenocrysts which is stratigraphically at the same level as the first unit; and the sill unit, which, based on its geochemistry, would be classified as a trachyandesite. The sedimentary units sandwiched between the flow units and the sill are arkosic sandstones and siltstones. Based on field relations and geochemistry, we developed a model for the origin of the rock units, which we believe are closely contemporaneous. According to our model, thin, submarine basalt flows were emplaced over wet sand, and the heat from the flows baked the upper layer of the sand. Subsequent basalt intrusion into wet sand underlying the baked zone led to a sill with a composition reflecting contamination of the basalt by the sand.

The ridge rock units have distinct physical properties, opening the possibility of geophysical modelling to further define the extent and geometry of the sill and flows in the subsurface. The first basalt unit and the sill rocks have a strong magnetic susceptibility, the basalt with plagioclase has a weaker magnetic susceptibility, and the magnetic susceptibility of the sedimentary units is effectively zero. A ground magnetic survey shows a strong magnetic signal over the east part of the ridge. To the west of the ridge it appears that the sill splits into thinner units. Results of a preliminary gravity survey show the importance of terrain corrections.

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