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An origin of marginal reversal of the Fongen-Hyllingen layered intrusion by prolonged magma emplacement

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The ∼100 m thick marginal zone of the Fongen-Hyllingen Intrusion (FHI) consists of nonlayered, highly iron-enriched ferrodiorites that are overlain by a ∼6 km thick layered sequence of gabbroic to dioritic rocks of the Layered Series. From the base upwards the marginal zone become more primitive as exemplified by a significant increase in whole-rock MgO, Mg-number, and normative An. The reverse trends are also evident from an upward increase in An-content of plagioclase (from ∼30 to ∼43 at.%) and Mg-number of amphibole (from ∼9 to ∼23 at.%) and clinopyroxene (from ∼23 to ∼37 at.%). The marginal zone is abruptly terminated at the contact with the overlying Layered Series as is evident from a step-like increase in Mg-number of mafic minerals and An-content of plagioclase, as well as a sharp increase in whole-rock MgO and Mg-number in overlying olivine gabbronorites of the Layered Series. Based on these features the marginal zone of the FHI can be interpreted as an aborted marginal reversal. Reverse trends in whole-rock and mineral compositions, as well as a sharp break in these parameters are indicative of its formation in an open system with the involvement of the prolonged emplacement of magma that became increasingly more primitive. Such development of the marginal reversal was interrupted by the emplacement of a major influx of more primitive magma that produced the Layered Series. The open system evolution of a basaltic magma chamber may represent a general mechanism for the origin of marginal reversals in mafic sills and layered intrusions.