

Opening Iapetus: Constraints from the Laurentian margin in Newfoundland

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ABSTRACT

Late Neoproterozoic to Early Cambrian geologic, geochronologic, and paleomagnetic data from along the Iapetus margin of Laurentia may be reconciled within a multistage rift history that involved an initial separation of Laurentia from the west Gondwana cratons ca. 570 Ma, followed by rifting of a further block or blocks from Laurentia ca. 540–535 Ma into an already open Iapetus Ocean to establish the main passive-margin sequence in the Appalachians. Paleomagnetic data suggest that Laurentia rifted from Amazonia/Rio de la Plata cratons and began its northward movement ca. 570 Ma to produce a wide Iapetus Ocean by 550 Ma. Geologic data from the Newfoundland segment of the Laurentian margin provide evidence for a rift-drift transition ca. 540–535 Ma, as constrained by the youngest rift-related magmatism at 550.5^{+3}_{-2} Ma (U/Pb zircon) for the Skinner Cove Formation and 555^{+3}_{-5} Ma for the Lady Slipper pluton, and a late Early Cambrian age of ca. 525–520 Ma for the oldest drift-related sedimentation. Rifting between the Laurentia and the west Gondwana cratons was probably distributed among multiple rift systems that fostered the production of a number of terranes (such as the Argentine Precordillera, Oaxacan) as well as the Iapetus Ocean. Development of Laurentian-derived Iapetan terranes during the final breakout of Laurentia from Rodinia may have been facilitated by preexisting 760–700 Ma rift weaknesses and apparently rapidly changing plate vectors during latest Neoproterozoic time.