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Geotectonic setting and paleogeography of a c. 565 Ma old Cadomian glaciation in NW Gondwana constrained by zircon U-Pb ages, Hf isotopes, and peri-Gondwanan zircon provinces

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The Cadomian Orogen (Cadomia) crops out mainly in the Bohemian, Armorican, French Central, and Iberian Massifs of the Variscides in Central and Western Europe. It is one of the most important marginal fold belts formed on the periphery of the western Gondwana Supercontinent during Mid-Late Ediacaran and Early Cambrian (Fortunian) times. The Cadomian Orogen was a Western Pacific style marginal orogenic system in part originated contemporaneously to the Pan-African orogens. The belt shows a distinct orogenic zonation consisting from NW to SE of (i) an outboard sitting continental crustal unit comprising Neoproterozoic rocks associated with c. 2.0 Ga old Icartian Basement, (ii) a magmatic arc and a back-arc basin, (iii) a foreland or retro-arc basin, and (iv) the passive margin of the back-arc basin. As a special feature, glaciomarine diamictites are intercalated into the foreland basin turbidites and the shelf deposits of the passive margin of Cadomian Gondwana having a pronounced importance for the palaeoposition of the entire arc-backarc system. U-Pb ages of detrital zircon and magmatic zircon suggest a sedimentation age at c. 565 Ma for the glaciomarine Weesenstein and Clanzschwitz tillites in the Bohemian Massif (Saxo-Thuringian zone) and Orellana tillites in the southern Central Iberian zone, all of which are very much younger than that of the c. 582 Ma old Gaskiers glaciation. Equivalents of glaciomarine diamictites are widely distributed in the Cadomian orogen and exists in Germany, Spain, and France. We propose for the new glaciation in NW Gondwana the term “Cadomian glaciation”. All these Cadomian tillites lack a cape dolomite, but the depositional age falls in the upper age range of the $\delta^{13}\text{C}$ Shuram-Wonoka anomaly. ϵHf isotopes of detrital and magmatic zircon point to an (Cadomian) magmatic arc in the source area, which recycled an 2-3 Ga old crust. Detrital zircon populations (zircon provenance) constrain a marginal setting onto the West African craton at c. 565 Ma. The new glacial event seems to be a local one situated approximately at the south pole position at that time. The glaciation forms a new bottleneck for the evolution of life and the rise of the Ediacaran biota.

