The Central Iapetus Magmatic Province (CIMP) Large Igneous Province. Distribution, nature, origin, and environmental impact

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The so-called Central Iapetus Magmatic Province (CIMP) was emplaced during Ediacaran-Cambrian times, and has been linked to the disruption of the supercontinent of Rodinia (Pannotia) leading to the initial opening of the Central Iapetus Ocean in the triple junction Laurentia, Baltica, and Amazonia or northwestern Africa. As for the Central Atlantic Magmatic Provinc (CAMP), the Central Iapetus LIP group has been variably considered as the result of a mantle super-plume or of heat incubation below the Rodinian (Pannotian) super-continent. Although major volcanic events are commonly associated with environmental hardship and even mass extinction (example CAMP versus Triassic-Jurassic mass extinction), the CIMP LIP group correlates with the beginning of a major expansion in the diversity and quantity of marine life during the early Cambrian: the Cambrian bio-radiation event (e.g., Puffer, 2002, American Journal of Science, v. 302, pp. 1-27.). It correlates also with the last Precambrian glaciation: the so called Gaskiers glaciation that occurred around 580 Ma. Major glaciations, are associated to an extensional context and to LIPs. Volcanic activity may have enhanced the climate change (e.g., Stern et al., 2008, Springer Solid Earth Series “Links between Geological Processes, Microbial Activities, and Evolution of Life”. Y. Dilek, H. Furnes, K. Muehlenbachs Eds., pp. 313-337). These authors develop and explore the hypothesis that explosive volcanism was at least partly responsible for Neoproterozoic climate change, synopsized as the “Volcanic Winter to Snowball Earth” (VW2SE) hypothesis. The CIMP magmatism is best studied along the Laurentian margin and has main pulses at ca. 615 Ma, 590 Ma, 560 and 550 Ma, which are potentially linked with the progressive breakup of the eastern Laurentian margin. It is also present in Baltica where it is best expressed by the Ediacaran CFB from the southwestern margin of the East European Craton in Ukraine. Whole-rock $^{40}Ar/^{39}Ar$ age determination revealed plateau ages at 590–560 Ma (Elming et al., 2007. Journal of the Geological Society, London, v. 164, pp. 969–982). In Africa, the CIMP LIP group is well represented around the West African Craton, in particular in its northwestern part: the High and the Anti-Atlas of Morocco, where it occurs as dyke swarms (Ediacaran Assarag-Douar Eçour dyke Swarms) that represent the feeder dykes of the volcanic successions of the Ouarzazate Group (formerly “PIII” of Choubert, 1963, Notes et Mémoires Service. Géologique du Maroc, Tome 1, n° 162, 352p.). The Ouarzazate Group represents a volcano-sedimentary sequences highly variable in thickness consisting of coarse volcanic conglomerates, ignimbritic rhyolites, trachytes, andesites, basalts, tuffites, and rare interbedded stromatolitic layers and fault scarp breccias. Various types of intrusions, such as granitoid massifs, necks, dykes or ring dykes are emplaced within the early Ouarzazate Group and within underlying units. Felsic volcanics from the Ouarzazate Group were dated in several inliers: between 575 and 560 Ma in the Sirwa Window (U–Pb SHRIMP on zircons, Thomas et al., 2002, Precambrian Research, v. 118, pp. 1–57.); 563 ± 5 Ma and 580 ± 12 Ma in the Central Anti-Atlas (U–Pb zircon; Mifdal and Peucat, 1985); 565 ± 7 Ma in the Tagragra de Tata inlier (U–Pb SHRIMP on zircons; Walsh et al., 2002, Precambrian Research, v.117, pp. 1–20); 550 ± 3 Ma in the Imiter inlier (U–Pb IMS 1270 on zircons; Cheilletz et al., 2002, Mineralium Deposita, v. 37, pp. 772–781.). The Ouarzazate Group has not recorded the Pan-African deformation, but was deposited on a highly variable basement topography, which, coupled with the large and rapid variations in thickness of the Ouarzazate Group itself, strongly suggests that this group was deposited during active tectonics, most probably associated with transtensional movements.