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The tectono-sedimentary evolution of North Helvetic Flysch basin in Central Alps as revealed by detrital zircon U–Pb age dating and Hf isotope geochemistry

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Palaeogene syn-tectonic volcanic products sparsely occur in the North Helvetic Flysch, which mainly deposited in the Northern Alpine Foreland Basin. However, the volcaniclastic provenance of the North Helvetic Flysch and its counterparts in Central Alps is still a matter of debate. We investigate the Early Oligocene (Rupelian) turibidite deposits to evaluate their temporal and genetic relationship with the hypothetical magmatic provinces and basement. Detrital zircons from several representative localities (Haute-Savoie, Alpe de Taveyannaz, Glarus and Trento area) have been dated by LA-ICP-MS analysis methods. The obtained age patterns are compared with trace element analysis and 176Hf/177Hf isotope of detrital zircons, which indicate the magmatic environment of zircons crystallization. The ages of detrital zircons show two major populations: a large dominance (92%) of pre-Alpine zircons (Cadomian, Caledonian, Variscan and post-Variscan, ca. > 252 Ma) as commonly observed in other Alpine Flysch formations, which derive from the basement and sedimentary cover of the South Alpine and Austroalpine units. Few Neo-Alpine ones (8%) in the range from Late Eocene to Early Oligocene ($\sim$39.8$\pm$0.7–29.7$\pm$0.8 Ma) occur, which match the geochronologic data of the Adamello ($\sim$42-33Ma), Biella ($\sim$34-31Ma) and Bergell ($\sim$32-29 Ma) intrusions. With regard to the REE and Hf isotope signatures, it appears that the volcanic fragments were derived from related dykes and surficial extrusions. In addition, the discovery of the minor Neo-Alpine zircons may be due to low zircon production in the volcanic belt along the Palaeo-Insubric line. However, a long distance transport of the syn-sedimentary volcanic material and mixing with various Alpine basement and cover sources is also suggested.