The Jurassic rift-related fault system and its Alpine re-activation history (central Southern Alps, N Italy): clues from structural analysis and paleo-fluid characterization

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The central Southern Alps (Seriana Valley, Bergamo) is characterized by a complex polyphasic evolution (Zanchetta et al., 2015) resulting from the re-activation of extensional faults related to the Jurassic rifting during the Alpine deformation, as well as the development of new structures. At least three different events were identified on the base of cross-cutting relationships between structures and magmatic bodies (Zanchi et al., 1990): 1) Early Jurassic N-S oriented normal faults, several kilometers in length, bordering a graben; 2) the intrusion of E-W trending andesitic dikes dated at 40 Ma (U-Pb zircon ages; D'Adda et al., 2011); 3) the reactivation of Jurassic normal faults as sinistral or dextral strike-slip faults during the N-S oriented Alpine compression, which caused southward translation of the Dolomia Principale dominated thrust sheet, probably during the late Cenozoic (Zanchi et al., 1990).

To understand this complex tectonic evolution, field work has been performed North of Bergamo (Amora, Selvino area) where the transition from pre-rift (Rhaetian) to syn-rift (Hettangian) succession is preserved and where the Alpine tectonics, postdating this Jurassic extensional event, is well expressed by transcurrent and reverse faults. Furthermore, clear cross-cutting relationship between the main tectonic features are well exposed in this area; field work focused on the reconstruction of the geometrical features of reverse, normal and strike-slip faults, joints, and veins, allowing for the identification of at least three tectonic phases, as described by Zanchi et al. (1990).

Field work led to the identification of a graben filled by Jurassic basin sediments whose bordering faults (N-S trending) were activated as transcurrent faults during the Alpine compression. Despite the Alpine reactivation, the syndepositional Lower Jurassic activity of these faults is documented by stratigraphic evidence, such as slump overfolds and mass flow deposits in the Lower Jurassic cherty limestone filling the basin (Moltrasio Limestone). Statistical methods for palaeoflow definition (Rodrigues et al. (2021) have been applied to the mass-transport deposits exposed within the Moltrasio Limestone in the hanging wall of the reactivated Jurassic extensional faults.

The preliminary field data highlighted the importance of this area for the understanding of the evolution of the central Southern Alps: microstructural analyses on syn-tectonic calcite veins from the Norian to the Lower Jurassic successions, fluid inclusions analysis, O-C stable-isotopes, and clumped isotopes (Δ_{47}) analyses, together with U-Pb dating of calcite, will help in the reconstruction of the tectonic, burial, thermal and paleo-fluid flow history of this sector of the central Southern Alps.

References

D'Adda P., Zanchi A., Bergomi M., Berra F., Malusà M. G., Tunesi A. & Zanchetta S. 2011. Polyphase thrusting and dyke emplacement in the central Southern Alps (Northern Italy). Int. J. Earth Sci., 100, 1095–1113.

Rodrigues M. C. N. L., Trzaskos B., Alsop G. I., Vesely F. F., Mottin T. E. & Schemiko D. C. B. 2021. Statistical analysis of structures commonly used to determine palaeoslopes from within mass transport deposits. J. Struct. Geol., 151, 104421.

Zanchetta S., Malusà M. G. & Zanchi A. 2015. Precollisional development and Cenozoic evolution of the Southalpine retrobelt (European Alps). Litosphere, 7, 662–681.

Zanchi A., Chinaglia N., Conti M., De Toni S., Ferliga C., Tsegaye A., Valenti L. & Bottin R. 1990. Analisi strutturale lungo il fronte della Dolomia Principale in bassa Val Seriana (Bergamo). Mem. Soc. Geol. It., 45.