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Special Issue: Evolution of collisional orogens in space and time—the Alpine-Himalayan system in 4 dimensions

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This Special Issue of the Swiss Journal of Geosciences entitled "*Evolution of collisional orogens in space and time: the Alpine-Himalayan system in 4 dimensions*", was proposed during the joint meeting "Geosciences for a sustainable future" organized by the Società Geologica Italiana and Società Italiana di Mineralogia e Petrografia held in Turin (Italy) in September 2022.

The issue focuses on the evolution of collisional orogens through a multidisciplinary approach. As a matter of fact, continental plate collisions give rise to collisional-related orogenic belts that are some of the most spectacular and dominant features on our planet.

During collision of continental plates, considerable deformation occurs with large scale overthrusting, burial and metamorphism of continental lithosphere portions. The final anatomy and the shape of collisional belts are highly diverse, due to the interactions of several controlling factors, including the pre-collisional tectonic history, the rate and the angle of convergence, the mechanical strength and thermal state of the involved colliding plates.

The youngest collisional system on Earth is the Alpine-Himalayan belt, extending from Spain to Southeast Asia. Its general structure was first described by Emile Argand in "La tectonique de l'Asie". On the occasion of the centenary of Argand's work, presented during the XIII International Geological congress in Belgium (August 10, 1922), this thematic volume aims to provide an updated view on the Alpine-Himalayan geology.

This Special Issue collects multidisciplinary contributions focusing on the Alpine-Himalayan system, dealing with the reconstruction of the tectonic architecture at different scales, integrating field mapping to microscale and describing the tectono-metamorphic evolution.

The papers included in this collection span from the Himalaya to the Western, Central and Ligurian Alps and also include a paper on the Alborz Mountains in Iran.

The publication by Robyr (2023) brings us in the Himalayan belt (Miyar Valley, North-West India) and focuses on the old history of the belt studying the pre-Himalayan metamorphism of the metamorphic core of the chain, until now strongly debated. Through phase petrology and microtectonics studies, combined with valuable field data, Robyr demonstrates the existence of a pre-Himalayan orogenic cycle.

Pantet et al. (2024), focus on the region surrounding the Zermatt area (SW Switzerland and NW Italy) where continental and oceanic units are strongly imbricated. Starting from a very detailed field mapping, they focus on the structure and stratigraphy of the Permian-Jurassic continent-derived Faisceau Vermiculaire series and associated non-ophiolitic Upper Cretaceous calcschists (Série Rousse), both intercalated within ophiolitic units. They were able to reconstruct the architecture of the Briançonnais-Prepiemont palaeomargin before the onset of Alpine deformation and the structural evolution through polyphase deformation during Alpine Tectonics.

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Dana et al. (2023), investigate the structural architecture and tectono-metamorphic evolution of Briançonnais units along the Ubaye–Maira valleys (South-Western Alps) at the French-Italian boundary. The Authors, starting from detailed geological mapping and integrating microstructural and metamorphic data, obtained with the Raman Spectroscopy of Carbonaceous Material, reconstruct the evolution of the subducted Briançonnais passive margin from the pre-rifting to the Alpine collisional stage.

Manna et al. (2023), present new geological data from the Ligurian Alps. The Authors, with the aid of structural mapping, UAV photogrammetric survey and digital outcrop modelling, report the first description of a 15 km-long NE-SW-striking transtensive fault network (referred to as *Horse Head Fault Zone*) crosscutting the metamorphic units of the area. This fault zone accommodated tens of km-scale displacements related to the Adria counterclockwise rotation after the Adria-Europe collision and the beginning of the Apennine subduction rollback.

Zanchetta et al. (2024), study the Permian Val Biandino Intrusive Suite in the central sector of the South Alpine Domain (N Italy). The Authors present new detailed petrographic, geochemical, and geochronological data of this intrusive Complex emplaced in the Variscan metamorphic basement. On the basis of their new data, they provide an updated picture of the Val Biandino Intrusive Suite, demonstrating how, despite its relatively small size, it displays a significant heterogeneity in terms of rock varieties intruded in a short time interval (ca. 5 Myrs). They conclude that the Val Biandino Intrusive Suite was likely formed through the interaction of magma generated at the mantle/crust transition and partial melting of the heterogeneous pre-Permian basement of the Southalpine Domain. These processes were linked to early Permian crustal extension and heat advection from the asthenosphere.

Rezaei et al. (2023), take us back to Asia, to the Alborz Mountains of north Iran. They investigate cumulate gabbroic rocks intruding Palaeozoic metasediments and Mesozoic sediments in the Gasht-Masuleh area. With the aid of petrographic analysis, whole-rock and mineral chemistry, as well as geochronology, the Authors were able to relate the mafic magmatism of the area to extension resulting from far-field effects linked to roll-back of the Neo-Tethys subducting slab in the mid-Cretaceous time.

Last but not least, we want to thank all the Authors who contributed to this special issue presenting their works from different sectors of the Alpine-Himalayan orogenic system. We are also very grateful to the reviewers that strongly contributed to improve the quality of the manuscripts and helped for successfully publishing this Special Issue.

Author's contribution
CM writing, editing; SI writing, editing; JLE writing, editing; PM writing, editing.

Data availability
Not applicable.

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References

Dana, D., Iaccarino, S., Schmid, S. M., Petroccia, A., & Michard, A. (2023). Structural and metamorphic evolution of a subducted passive margin: Insights from the Briançonnais nappes of the Western Alps (Ubaye–Maira valleys, France–Italy). *Swiss Journal of Geosciences, 116*, 18.

Manna, L., Perozzo, M., Menegoni, N., Tamburelli, S., Crispini, L., Federico, L., Seno, S., & Maino, M. (2023). Anatomy of a km-scale fault zone controlling the Oligo-Miocene bending of the Ligurian Alps (NW Italy): Integration of field and 3D high-resolution digital outcrop model data. *Swiss Journal of Geosciences, 116*, 15.

Pantet, A., Epard, J.-L., & Masson, H. (2024). Continent-derived metasediments (Cimes Blanches and Frilihorn) within the ophiolites around Zermatt: Relations with the Mischabel backfold and Mont Fort nappe (Pennine Alps). *Swiss Journal of Geosciences, 117*, 10.

Rezaei, L., Timmerman, M. J., Moazzen, M., Altenberger, U., Sláma, J., Sudo, M., Günter, C., Wilke, F. D. H., & Schleicher, A. M. (2023). Mid-Cretaceous extensional magmatism in the Alborz Mountains, north Iran; geochemistry and geochronology of Gasht-Masuleh gabbros. *Swiss Journal of Geosciences, 116*, 14.

Robyr, M. (2023). Evidence for a pre-Himalayan metamorphism in the High Himalayan Crystalline of the Miyar Valley (NW India). *Swiss Journal of Geosciences, 116*, 17.

Zanchetta, S., Crippa, C., Zanchi, A., & Montemagni, C. (2024). The Val Biandino Intrusive Suite (central Southern Alps, N Italy): New geochronological and geochemical data on the Early Permian magmatic activity in the Southalpine Domain. *Swiss Journal of Geosciences, 117*, 7.

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