

A GEOLOGICAL SECTION ACROSS THE “GRAND SAINT BERNARD NAPPE” IN THE SOUTHERN AOSTA VALLEY (WESTERN ALPS, ITALY)

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The results of detailed geological mapping carried out on the southern side of the Aosta valley (Valgrisenche, Val di Rhemes, Valsavarenche and Val di Cogne) allow to outline the setting of the Penninic nappe pile exposed in this area.

The present structural setting through the southern Aosta Valley cross-section is the result of a complex and polyphasic evolution: basement units described in the literature as belonging to the Grand Saint Bernard nappe have followed independent PT paths during the Alpine orogenesis and now they are juxtaposed in the nappe stack and sandwiched between ophiolitic units.

The lowest structural element of the investigated area is the ophiolitic Gran Vaudala tectono-metamorphic unit (TMU, *sensu* SPALLA et al., 1998), which is characterized by a blueschist facies metamorphism of Alpine age. It is the footwall of the Grand Saint Bernard nappe and it is tectonically overlaid by the Gran Nomenon basement unit along the Entrelor thrust, an important shear zone involving slices of both basement and cover rocks recrystallized under greenschist facies conditions (FREEMAN et al., 1997).

Moving towards the higher and more external Grand Saint Bernard nappe portions exposed along the Valgrisenche – Val di Cogne transect, it is possible to distinguish other basement units: the Pra d’Amont TMU, which overlays the Gran Nomenon TMU by means of the Feleumaz shear zone, and the Leverogne and Ruitor TMU’s, that are separated by means of the Avise shear zone. These shear zones consist of west-dipping low-angle tectonic contacts in which basement, cover

and ophiolitic rock elements are preserved. Kinematic data are consistent with a tectonic transport direction towards east.

Therefore, the actual setting of the Grand Saint Bernard nappe and the “Piedmont zone” in the southern Aosta Valley is more complicated respect to the picture usually described in the literature. On the basis of the new stratigraphic, structural and metamorphic data collected in the part of Grand Saint Bernard nappe exposed on the southern side of the Aosta Valley, it is possible to recognize the following tectono-metamorphic units:

the Ruitor TMU, a polymetamorphic basement unit comprising metasedimentary rocks and metagranitoids of Ordovician age (460–470 Ma, BERTRAND et al., 2000b) with eclogite facies relics and blueschist facies overprinting of Alpine age

the Leverogne TMU, consisting of metasedimentary rocks with minor metabasites, which differs from the Ruitor TMU for the lack of metagranitoids and for the pervasive blueschist and greenschist facies metamorphic overprinting of Alpine age

the Pra d’Amont TMU, which contains albite-rich micaschists with minor metagranophyres of Cambrian age (511 Ma, BERTRAND et al., 2000a), characterized by a blueschist facies metamorphism of Alpine age followed by a re-equilibration under greenschist facies conditions the polymetamorphic Gran Nomenon TMU, constituted by metagranodiorites of lower Devonian age

(363 Ma, BERTRAND et al., 2000b) intruded in a basement mainly consisting of metasedimentary rocks, which shows a slight greenschist facies metamorphic imprint of Alpine age.

In this area, the TMU's classically ascribed to the "Piedmont zone" form shear zones of variable thickness which separate different basement units. They are characterized by metamorphic assemblages of both greenschist facies (Entrelor and Feleumaz shear zones) and blueschist facies metamorphism (Avisè shear zone).

As a consequence the juxtaposition of the Grand Saint Bernard basement TMU's has occurred at different structural sites and at different times during the Alpine orogenesis. Therefore the present tectonic setting of the southern Aosta Valley transect could be the result of complex uplift trajectories occurred inside the orogenic wedge developed on the Apulian margin.

References

- BERTRAND, J.M., GUILLOT, F. & LETERRIER J. (2000 a): Age Paléozoïque inférieur (U-Pb sur zircon) de métagranophyres de la nappe du Grand Saint Bernard (zona interna, vallée d'Aoste, Italie). – C.R. Acad. Sci. Paris, Earth Planet. Sci., **330**, 473–478.
- BERTRAND, J.M., PIDGEON, R.T., LETERRIER, J., GUILLOT, F., GASQUET D. & GATTIGLIO, M. (2000 b): SHRIMP and IDTIMS U-Pb zircon ages of the pre-Alpine basement in the Internal Western Alps (Savoy and Piedmont). – Schweiz. Mineral. Petrogr. Mitt., **80**, 225–248.
- FREEMAN, S.R., INGER, S., BUTLER, R.W.H. & CLIFF, R.A. (1997): Dating deformation using Rb-Sr in white mica: Greenschist facies deformation ages from the Entrelor shear zone, Italian Alps. – Tectonics, **16**, 1, pp. 57–76.
- SPALLA, M.I., GOSSO, G., SILETTO, G.B., DI PAOLA, S. & MAGISTRONI, C. (1998): Strumenti per individuare unità tettono-metamorfiche nel rilevamento geologico del basamento cristallino. – Mem. Sci. Geol., **50**, 155–164.

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