JOURNAL OF MAPS
2020, VOL. 16, NO. 2, 736–744
https://doi.org/10.1080/17445647.2020.1824825

Taylor & Francis
Taylor & Francis Group

Science

Geology of the southern Dora-Maira Massif: insights from a sector with mixed ophiolitic and continental rocks (Valmala tectonic unit, Western Alps)

Gianni Balestro [a], Francesco Nosenzo [b], Paola Cadoppi [a], Gianfranco Fioraso [c], Chiara Groppo [a] and Andrea Festa [a]

[a]Department of Earth Sciences, University of Torino, Torino, Italy; [b]Department of Geological Sciences, Stockholm University, Stockholm, Sweden; [c]Institute of Geoscience and Earth Resources, National Research Council, Torino, Italy

ABSTRACT

In the Valmala sector of the southern Dora Maira Massif (Western Alps), two different eclogite- and blueschist-facies units (i.e. the Rocca Solei and Dronero units, respectively), are separated by a shear zone (i.e. the Valmala Tectonic Unit), which peculiarly consists of mixed slices of ophiolitic and continental rocks. A detailed geological map at 1:10,000 scale allowed to point out that the tectonic slices within the Valmala Tectonic Unit consist of 'native' rock slices wrenched from the overlying Dronero Unit, and 'exotic' rocks likely sourced from other units of the Dora Maira and from a continental margin and an oceanic basin. On the contrary, rock slices sourced from the underlying Rocca Solei Unit are lacking. The overall tectonic stack results after an early subduction-related deformation phase (i.e. the D1), and the pervasive overprinting of two subsequent exhumation-related deformation phases (i.e. the D2 and D3). The Valmala Tectonic Unit is inferred to have played a role in decoupling the southern Dora Maira Massif during subduction, and/or in driving exhumation of the ultra-high pressure rocks occurring in the adjoining Brossasco-Isasca Unit.

ARTICLE HISTORY
Received 16 April 2020
Revised 8 September 2020
Accepted 14 September 2020

KEYWORDS
Alpine tectonics; Dora-Maira Massif; tectonic mélanges; ophiolites; shear zone

1. Introduction

The Western Alps represent one of the more studied orogens in the world. Nevertheless, a large part of this orogen lacks of detailed geological maps and the official Geological Maps of Italy at 1:100,000 scale are older than 50 years.

During the last tens of years, several works based on a detailed geological mapping, clearly documented that the Western Alps are characterized by complex structural and tectono-stratigraphic settings, part of which results from pre-orogenic structural inheritances (see e.g. Ballèvre et al., 2018; Bell & Butler, 2017; Festa et al., 2020; Mohn et al., 2011; Tartarotti et al., 2017, and reference therein), superposition of subduction- and exhumation-related deformation stages (see e.g. Federico et al., 2015; Manzotti et al., 2014; Roda et al., 2018, and reference therein) and late strike-slip to extensional tectonics (see e.g. Balestro et al., 2009; Perrone et al., 2010, and reference therein). This is the case of the Dora-Maira Massif (DM hereafter), a terrane of continental crust, worldwide known for the first discovery of coesite-bearing ultra-high pressure mineral assemblages (Chopin, 1984). Despite several metamorphic and petrological studies focused on the ultra-high pressure Brossasco-Isasca Unit (see e.g. Compagnoni et al., 2012; Ferrando et al., 2017, and reference therein), published data about the tectono-stratigraphic and structural setting of the whole DM are scattered and actually not exhaustive.

Throughout a detailed geological map at 1:10,000 scale (see Main Map), this paper provides new detailed information about the geology of a poorly known tectonic stack in the southern DM (i.e. the Valmala sector; Figure 1), which lies above the coesite-eclogite bearing Brossasco-Isasca Unit (Chopin et al., 1991; Kienast et al., 1991). In this sector, two different DM units (i.e. the eclogite-facies Rocca Solei Unit and the blueschist-facies Dronero Unit) are separated by a tectonic unit (i.e. the here defined Valmala Tectonic Unit), which peculiarly consists of mixed slices of ophiolitic and continental rocks.

2. Regional setting

The Western Alpine orogenic belt developed as a result of the collision between Adria, in the upper plate, and Europe, in the lower plate, after the closure of the interposed Ligurian–Piedmont oceanic basin (see e.g. Coward & Dietrich, 1989; Rosenbaum & Lister, 2005; Schmid et al., 2017, and references therein). The belt evolved through the (i) Late Cretaceous to Middle Eocene subduction, (ii) Late Eocene to Early Oligocene continental collision, and (iii) Late Oligocene to Neogene deep crust/mantle indentation (see e.g. Solarino et al., 2018, and references therein). The DM represents

CONTACT Gianni Balestro gianni.balestro@unito.it Department of Earth Sciences, University of Torino, Via Valperga Caluso 35, 10125 Torino, Italy