

Zeitschrift: Archives des sciences [1948-1980]
Herausgeber: Société de Physique et d'Histoire Naturelle de Genève
Band: 33 (1980)
Heft: 1-3

Artikel: High grade rodingites from the Central Alps : metamorphism and geochemistry
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DOI: <https://doi.org/10.5169/seals-739487>

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HIGH GRADE RODINGITES FROM THE CENTRAL ALPS: METAMORPHISM AND GEOCHEMISTRY

BY

Volkmar TROMMSDORFF¹ and Bernard W. EVANS²

High grade rodingites occur in at least two different suites in the Central Alps (Fig. 1). *The first suite* occurs in the Cima Lunga-Adula nappe (especially well developed in the area of Cima di Gagnone) and comprises mafic rocks consisting predominantly of garnet and clinopyroxene and varying from eclogite (CaO 12, Na₂O 2.8 weight percent) to metarodingite (CaO up to 25, Na₂O, O weight percent, Trommsdorff *et al.* 1975, Evans *et al.* 1979). Garnets vary correspondingly from pyralspite 84 ugrandite 16 to ugrandite 80 pyralspite 20 and clinopyroxenes from omphacite (jadeite 45) to diopside and fassite (Cats 23). Trace element abundances appear to have been little affected by the process of rodingitization and suggest sea floor basalt tholeiitic affinities of the suite.

Associated ultramafic bodies vary from chlorite-enstatite peridotite (with in part 0% CaO) enclosing rodingites, to garnet peridotite (CaO up to 4%) enclosing eclogite and are believed to at least in part represent progressively metamorphosed products of serpentinite.

For garnet peridotite and eclogites several independent geothermometers and —barometers suggest conditions of ~25kbar and 800° C (see also Heinrich (1978)). The same conditions hold for the rodingites based upon a new calibration for low Na-pyroxene-calcic garnet pairs by Ellis and Green (1979). Within the eclogites, metarodingites and garnet peridotite exchange equilibria of the high pressure assemblages were little affected by the later, main Alpine amphibolite facies metamorphism of the Central Alps.

However, in contact reaction zones between ultramafics and enclosed mafic lenses these early assemblages were destroyed by the main Alpine event resulting in partial amphibolitisation of eclogites and metarodingites.

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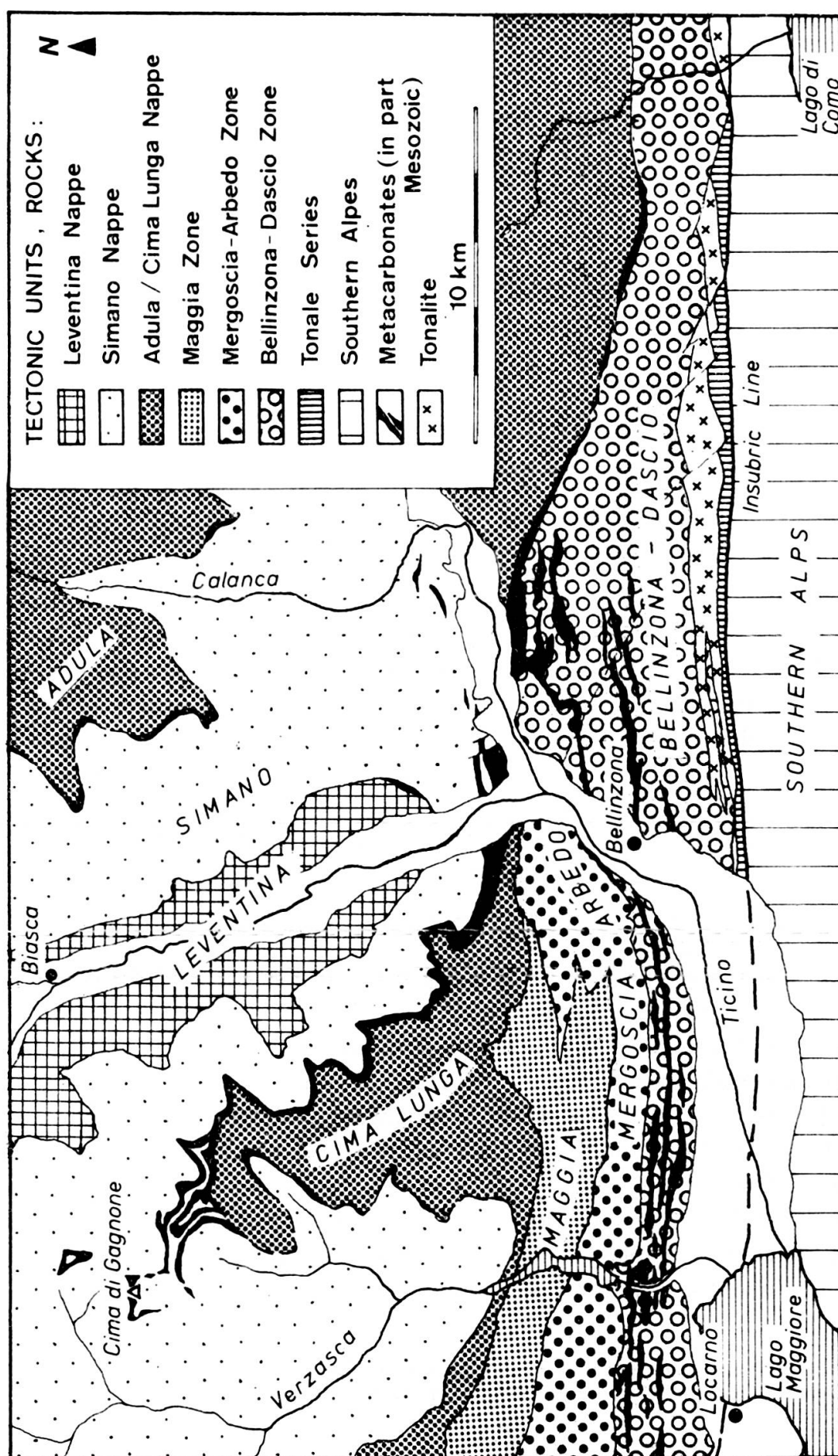


Fig. 1. — Outline tectonic map of the Central Alps near Bellinzona.

Table 1 gives a summary of events recognized for the mafic-ultramafic suite of Cima di Gagnone.

TABLE 1. — *Sequence of events in Cima-Lunga mafic-ultramafic rocks.*

Time	Stage	Event	Rock types	
			Lherzolithic ultramafics	Tholeiitic basalts
	Oceanic	serpentinization/ rodingitization	serpentinization	in part rodingitization
	Deep burial	High-pressure metamorphism (25kb/800 °C)	chlorite peridotite	metarodingite
			garnet peridotite	eclogite
	Alpine orogeny	Amphibolite facies meta- morphism	in part chlorite peridotite $\pm$ spinel	in part amphibolite (blackwall, amphiboliti- zation)

In the Bellinzona zone (Fig. 1), at Alpe Albion east of Bellinzona a *second ultramafic-rodingite suite* has been recognized. This suite shows no signs of an early high-pressure metamorphic event. The Alpine metamorphic event in this area was of sillimanite grade and the ultramafic rocks contain a spinel-tremolite-chlorite-enstatite-olivine assemblage. Metarodingite dykes are mostly flattened parallel to a strong Alpine foliation and are scarcely crosscutting. They resulted from original coarse grained dykes that locally show relic gabbro textures. Their CaO content varies from 20 to over 33 weight percent. The original inhomogeneity of these rocks lead to domains in the rodingites that are dominated by various minerals i.e. pyroxene domains with a highly fassaitic clino-pyroxene, epidote domains, garnet domains, vesuvianite domains and iron titanium oxide domains. In the complex mineral assemblages of the latter sphene, perovskite and melanite are found, in the vesuvianite domains xanthophyllite is not uncommon. Blackwall reaction zones between the ultramafics and metarodingite contain much chlorite, orthopyroxene, olivine, spinel, and calcic amphibole. Hoegbomite occurs in local association with spinel. Against the metarodingite a 5 mm wall of black hornblende is found.

This postkinematic hornblende frequently encloses clinopyroxene relics indicating at least growth of some blackwall material on expense of the metarodingite during Alpine metamorphism.

On the other hand shearing of blackwall within folded metarodingite boudins indicates formation of blackwall material in a prekinematic stage.

The petrogenetic history of the Bellinzona zone-ultramafics can be derived from these observations and involves at least three stages:

- 1) Metasomatic rodingitization of coarse grained gabbro dykes accompanying serpentinization of enclosing peridotite.
- 2) Severe deformation mylonitization and folding involving probably more than one event the last being Alpine in age.
- 3) Alpine metamorphism, sillimanite grade, in part postkinematic.

The subdivision of the Central Alpine ultramafics into two zones, one that has experienced high pressure metamorphism and one that doesn't is in agreement with observations by Fumasoli (1974). In both zones, however, an early stage of serpentinization accompanied by rodingitization is recognized.

ACKNOWLEDGEMENTS

The authors acknowledge the support of Schweizerischer Nationalfonds No. 2.115-0.78 and U.S. National Science Foundation (Grant EAR-78-03350).

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