METAMORPHIC FRAMEWORK OF THE ALPS — *CARTE METAMORPHIQUE DES ALPES*

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Map based of the "Metamorphic structure of the Alps" (2004) edited by

R. Oberhänsli, R. Bousquet, M. Engi, B. Goffé, G. Gosso, M. Handy, V. Höck, F. Koller, J.-M. Lardeaux, R. Polino, P. Rossi, R.Schuster, S. Schwartz, L. Spalla

GIS / *SIG*

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Spatial reference GCS WGS 84
Relief generated from SRTM 30sc elvation data by CGIAR-CSI
Bathymetry IFREMER data generated using Geomapapp

Bohemian Massif
Vosges
Black Forest
Rhine graben
Alps
Calcareous
Northern
Molasse basin
Jura
Bresse graben
Pannonian basin
Venetian plain
Dinarides
Adriatic sea
Po plain
Dauphine
Apennines
Provence
Ligurian-Provencal sea
Tyrrhenian Sea

Tectono-metamorphic age framework

Distribution des âges tectonométamorphiques

Scale 1:2 500'000

Age of dominant Alpine tectono metamorphic event

Imprint	*overprint*	*Basin formation*
20-0 Ma		
25-20 Ma		
32-25 Ma		
42-32 Ma		
47-42 Ma		
60-47 Ma		
70-60 Ma		
90-75 Ma		
110-90 Ma		

Metamorphic cross-sections

(modified after Bousquet et al., 2008)

Eastern Alps: TRANSALP

Central Alps: NFP-20 East

Northwestern Alps: NFP-20 West

Western Alps: ECORS-CROP

Age cross-sections

Eastern Alps : TRANSALP

Central Alps : NFP-20 East

Northwestern Alps : NFP-20 West

Western Alps : ECORS-CROP

Metamorphic assemblages

Diagenesis / sub anchizone — *zeolite / illite - kaolinite* — DIA
Sub greenschist facies — *kaolinite - pyrophyllite - chlorite ± illite* — SGS
Lower greenschist facies — *albite - chlorite / pyrophyllite - chlorite ± chloritoid* — LGS
Upper greenschist facies — *albite/oligoclase - biotite - chlorite - kyanite ± chloritoid* — UGS
High-pressure greenschist facies — *albite - low-si/si - chlorite ± zoisite / low-si/si - chlorite ± chloritoid ± kyanite* — HPGS

Blueschist facies — *glaucophane - low-si/si / carpholite - phengite ± pyrophyllite* — BS
Upper blueschist facies — *glaucophane - epidote - quartz / chloritoid - phengite ± garnet* — UBS
Blueschist-eclogite transition — *glaucophane - zoisite - garnet ± clinopyroxene / quartz - Mg-rich chloritoid - phengite* — BET

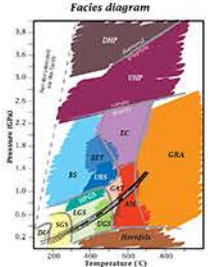
Eclogite facies — *garnet - omphacite / zoisite - quartz ± amphibole ± phengite / garnet - Mg-rich chloritoid - kyanite ± garnet - low-si/si* — ECL
Ultra high-pressure facies — *garnet-omphacite-kyanite ± phengite / coesite or Mg-rich chloritoid - talc - phengite* — UHP
Ultra high-pressure facies II — *Diamond bearing metamorphic rocks* — DHP

Greenschist-amphibolite transition — *albite - epidote - amphibole / biotite - garnet - chloritoid ± staurolite - chloritoid - kyanite* — GAT
Amphibolite facies — *plagioclase - hornblende - garnet / biotite - garnet - staurolite - phengite ± kyanite* — AM
Granulite facies — *plagioclase - K-fs - Cpx - garnet ± opx(-) ± sapp(-) Cpx - garnet - K-fs/kyanite - sapphirine ± cordierite ± sillimanite ± melt* — GRA
Migmatites — *In situ occurrences of late orogenic partial melting zone*

Metamorphic assemblages in and for — *green for mafic rocks, brown for metasediments*

5Ma — *Isotherms of the Tertiary barrovian (cold/classic) metamorphism*

Facies diagram



Rules for representation of metamorphic conditions

Plain colour
Single metamorphic peak always followed by cooling or isothermal retrograde events

Hatched colour
Metamorphic P-peak overcomed by a later thermal event

Marine Geology

- Mesozoic to tertiary thickness of thin soil and indurated sediments: mountains
- Continental margin
- Basement continental crust
- Tethyan volcanic rocks

Alpine related Magmatic rocks

- Polygenic intrusives — Magmatic rocks, undivided (e.g. Monte Rosa, Gran Paradiso, Adamello, Bergell)
- Aeromagnetic volcanites (e.g. Monte Cervino / Dent Blanche, Monte Rosa)
- Plio-miocene intrusives (e.g. Ivrea, Biella, Traversella)
- Plio-miocene volcanic rocks (e.g. Monte Vulture, Roccamonfina, Ischia, Vesuvius, Stromboli, Etna)

Tectonic contacts

- First order contact
- Second order contact
- Normal fault
- Strike-slip fault
- Tertiary rocks thrust deformed paleogeographic domains (dashed lines representing last orogenic movements)
- Tertiary rocks of a same paleogeographic domain (dashed lines representing last orogenic movements)

Occurrences

- Corundo
- Diamond
- Garnet-bearing peridotites

Citation
Bousquet R., Oberhänsli R., Schmid S.M., Berger A., Wiederkehr M., Rodert C., Möller A., Rosenberg C., Koller F., Meli C., Doussout R., Schuster R., Martinotti G., Ferrezoni M., Italy, 33 SGU/CGMW

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