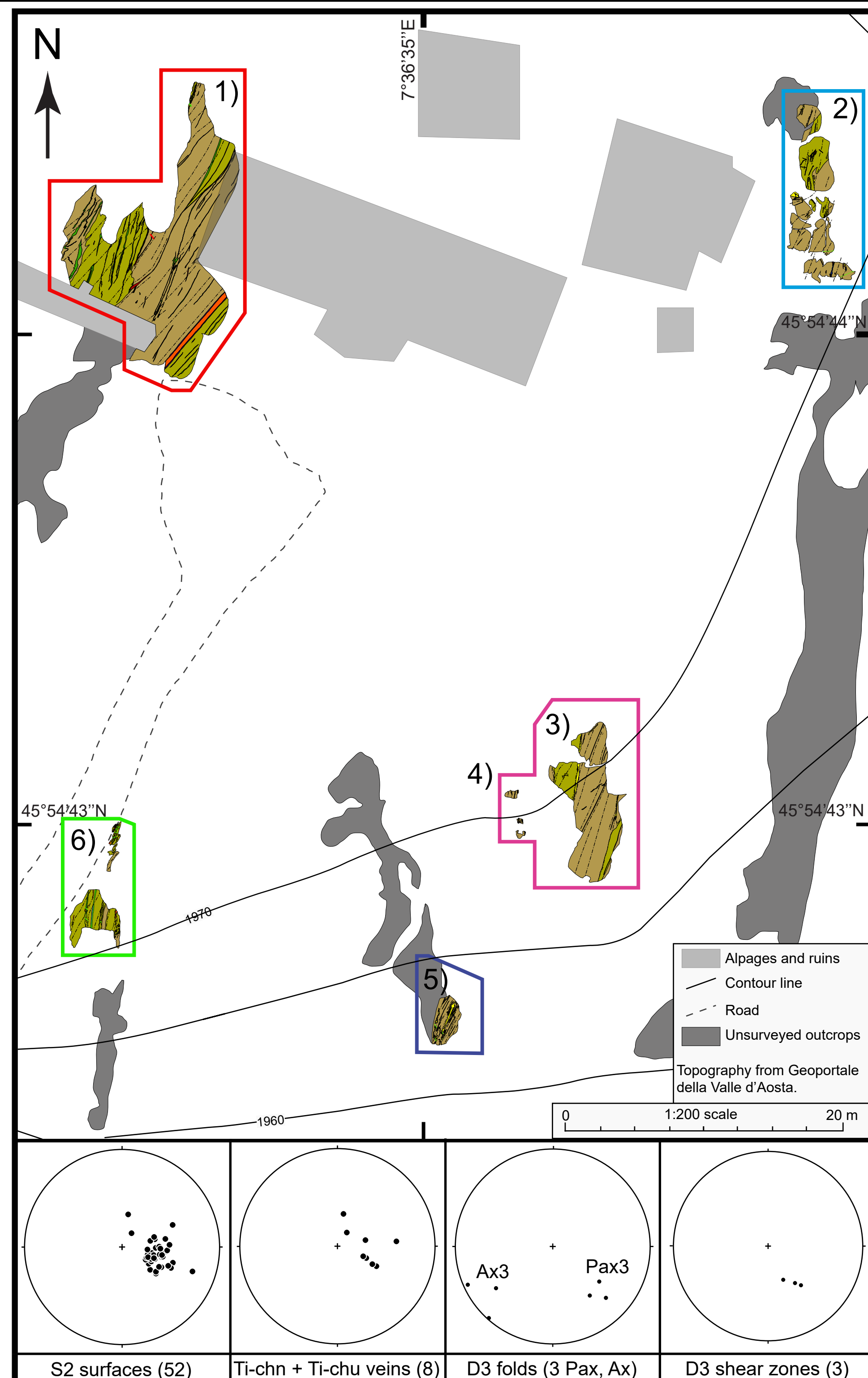
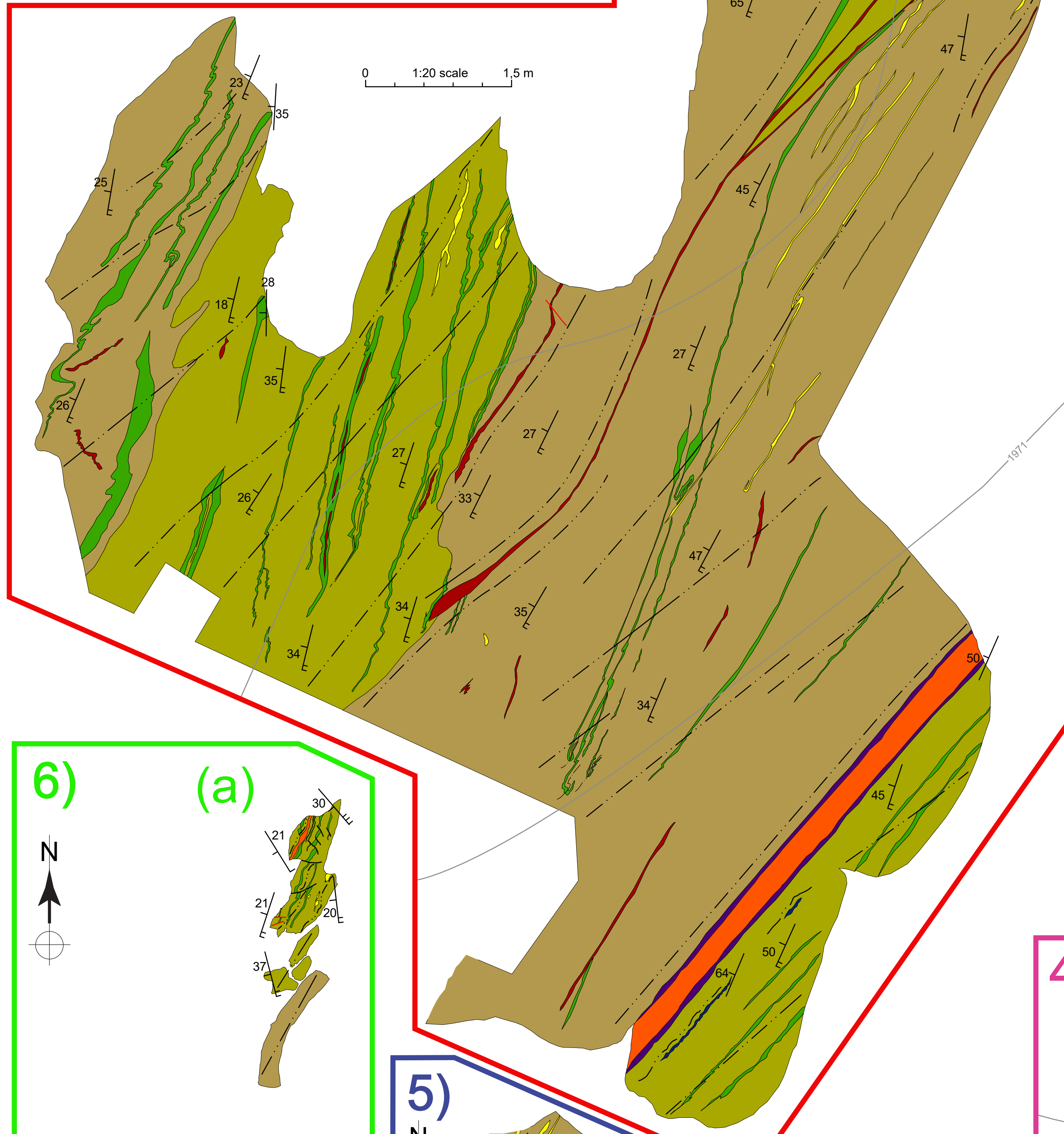
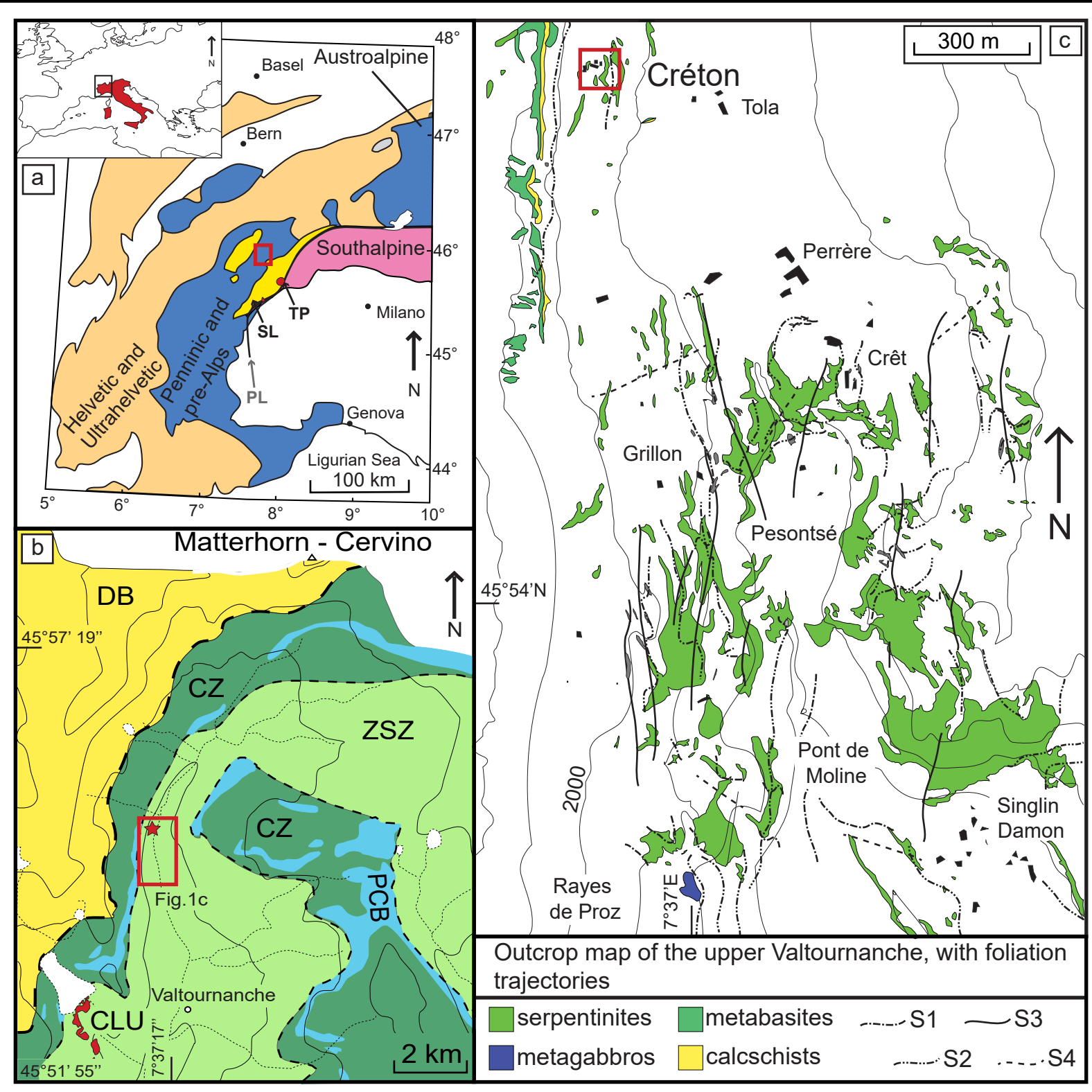




# Deformation history of Ultra High Pressure ophiolitic serpentinites in the Zermatt-Saas Zone, Crétón, upper Valtournanche (Aosta Valley, Western Alps)

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### LEGEND

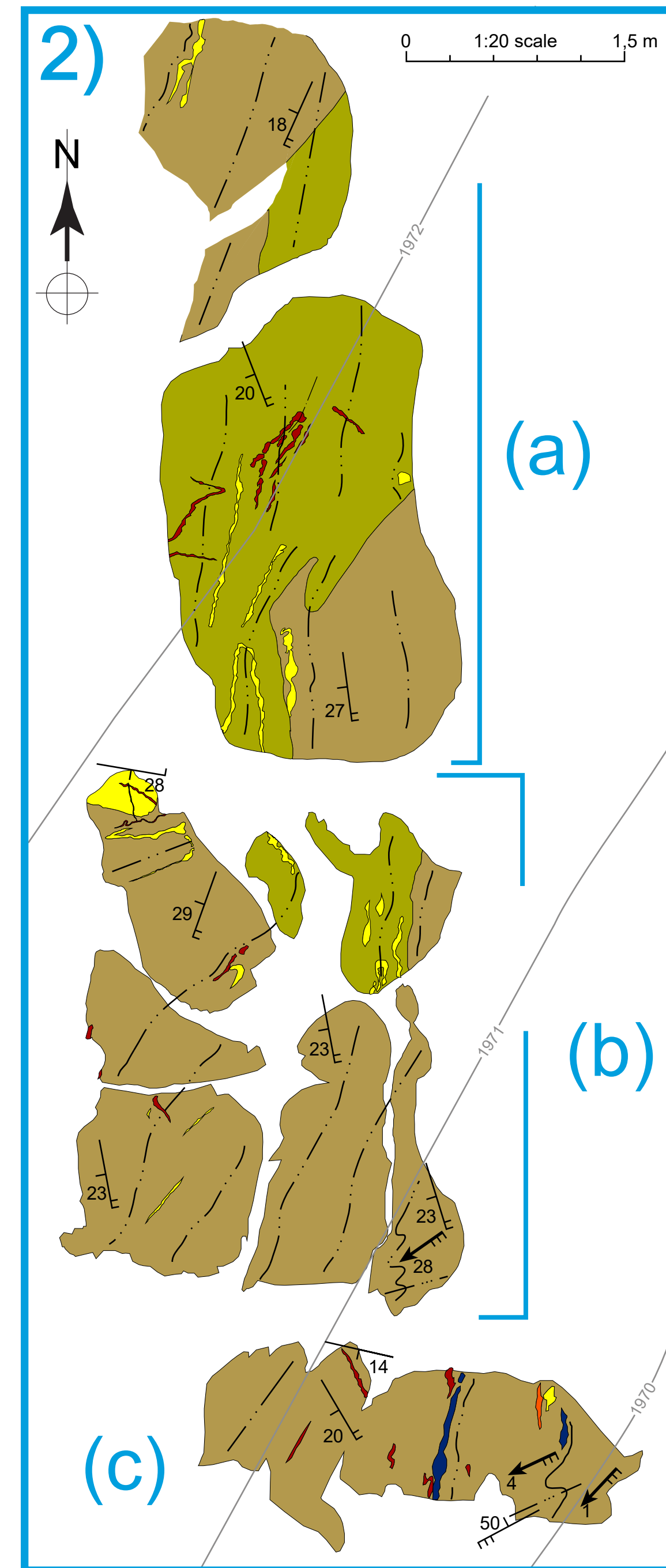
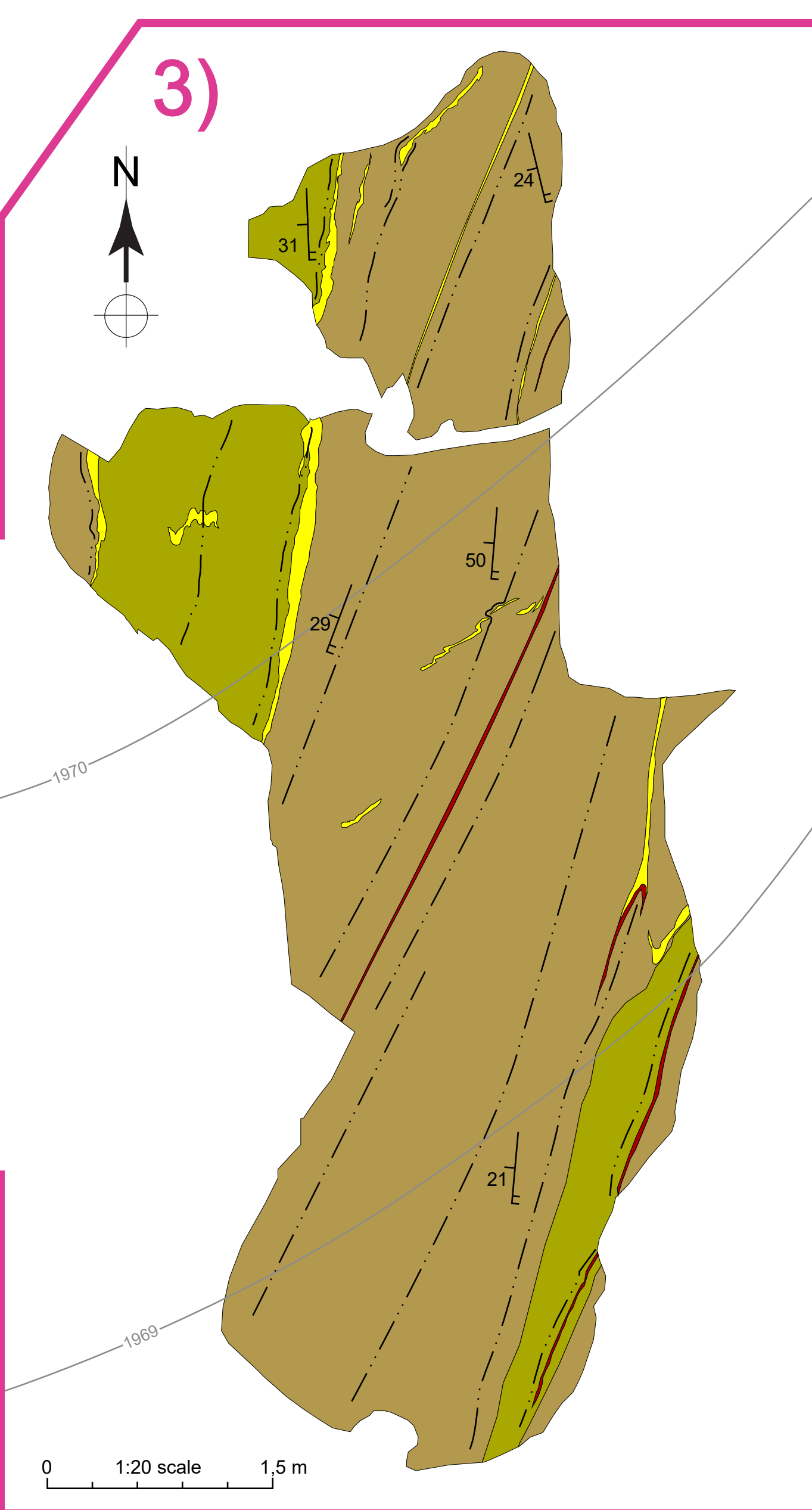
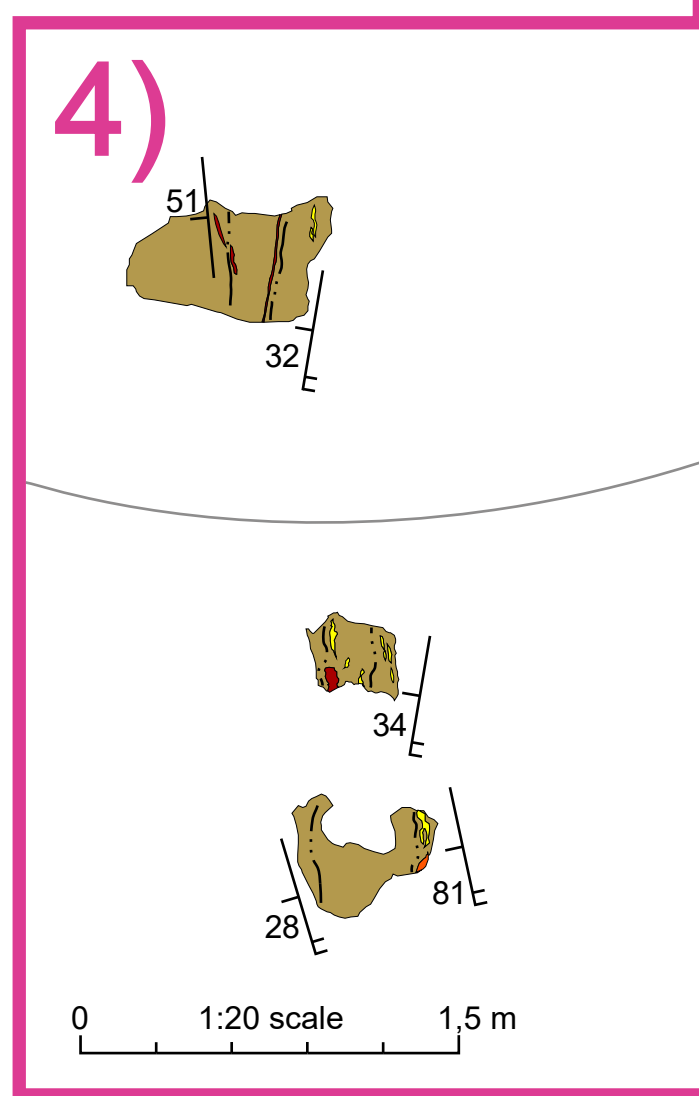
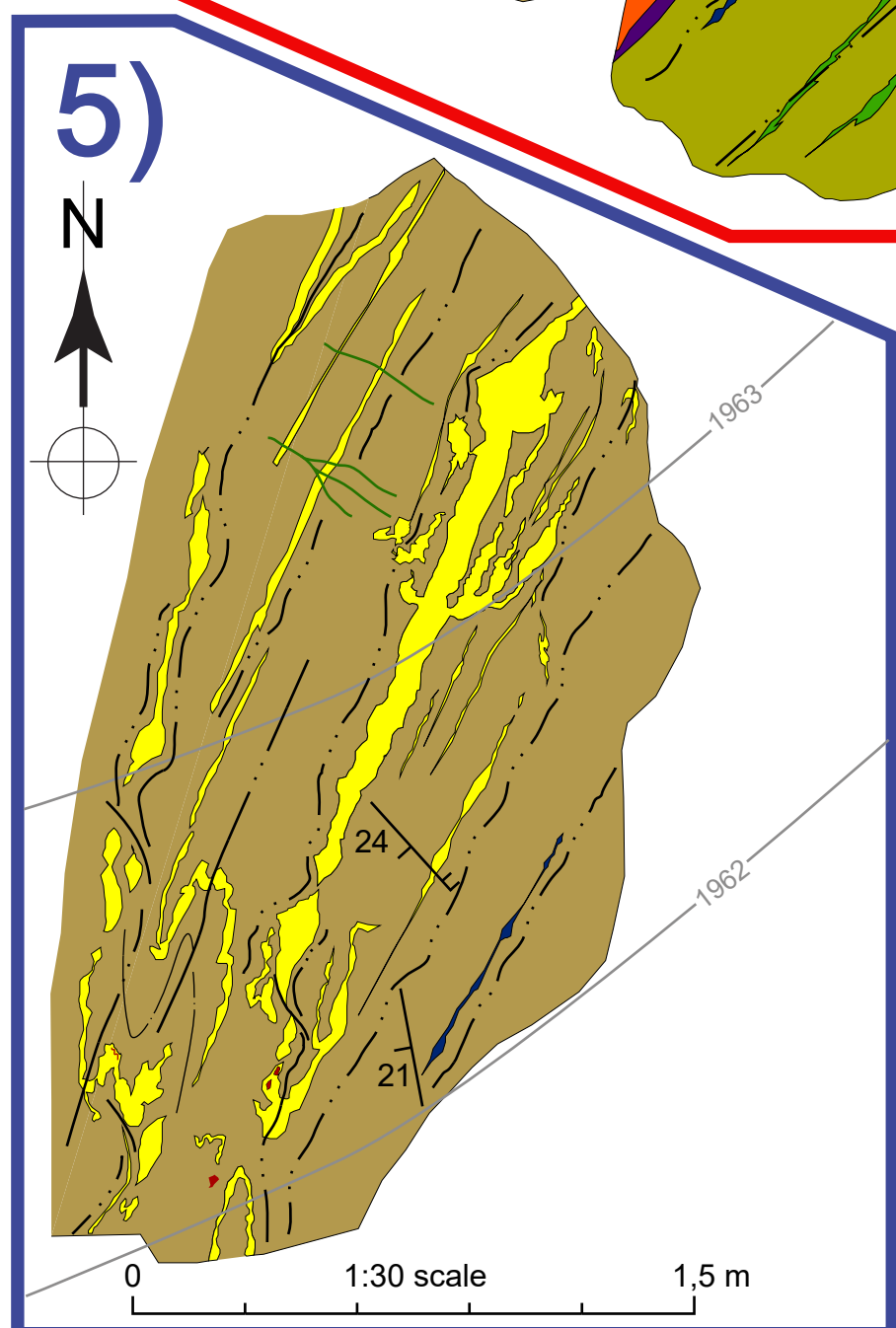
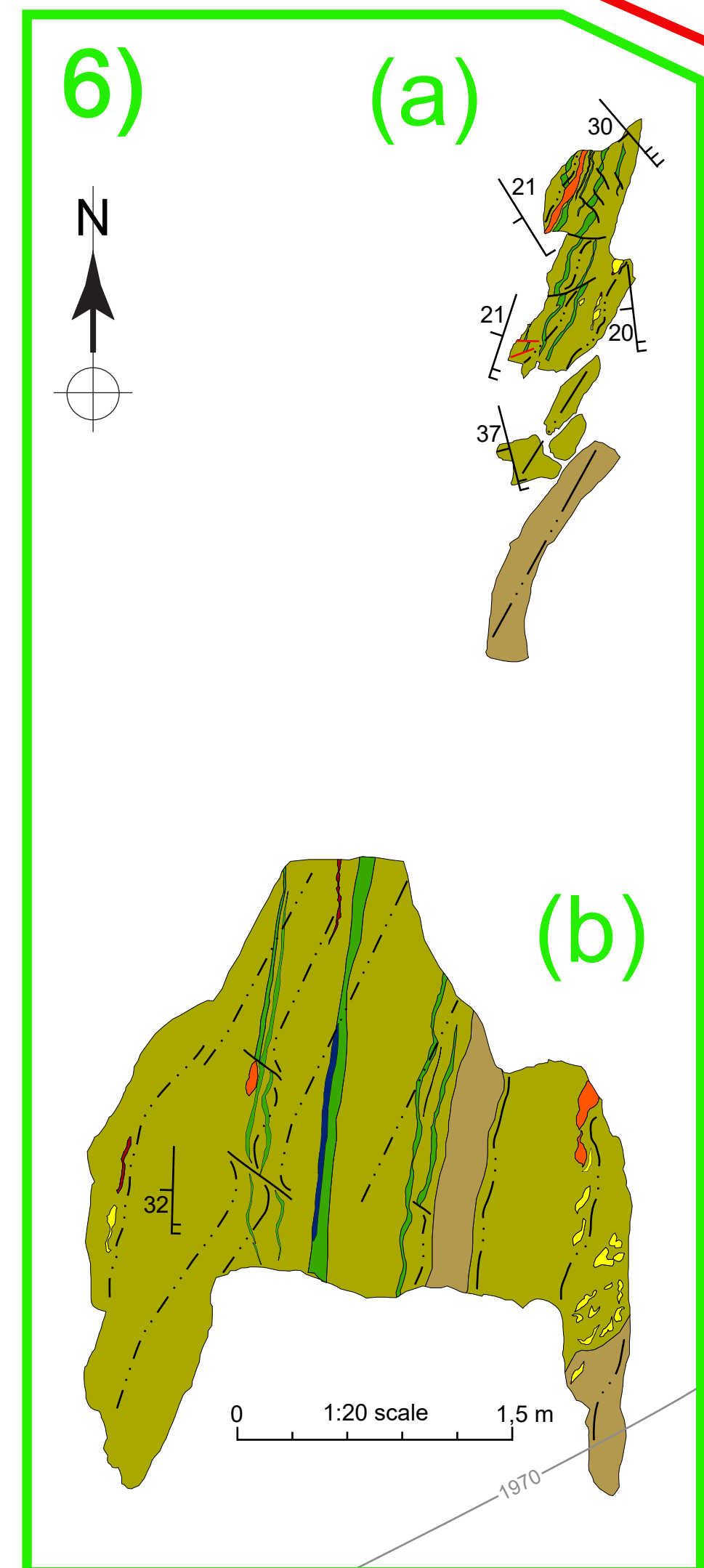
**Rock types**

- White-porphycroasts serpentinite (a)**  
Mylonitic serpentinite. Serpentine (60-90%), olivine/clinopyroxene (10-20%), magnetite (5-15%), calcite + dolomite (<5%), and locally chlorite and apatite. Outcrop altered surface are rich in white and pale grey of centimetre-sized oval domains in an aqua-green matrix.  
Assemblages: Pre-D2: Srp + Mag + Cpx/Ol + Ti-Chu + Dol + Ap + Dol. Syn-D2: Srp + Mag + Cpx/Ol + Ti-Chu + Chl + Cal + Dol. Post-D2: Srp + Mag + Chl.
- Olivine-rich serpentinite (b)**  
Mylonitic serpentinite. Serpentine (50-60%), olivine (20-30%), magnetite (5-15%), chlorite (<5%), and locally clinopyroxene and amphibole. Rich in millimetre- to submillimetre-thick olivine veins, the rock and the olivine veins are affected by mylonitic S2 foliation. Outcrop altered surface is from ochre, yellow to brownish.  
Assemblages: Pre-D2: Srp + Mag + Ol + Ti-Chu. Syn-D2: Srp + Mag + Ol + Ti-Chu. Post-D2: Srp + Mag + Chl.
- Magnetite layers (c)**  
Both serpentinite types are rich in layers constituted by magnetite (50-60%), serpentine (20-30%), and locally olivine (10-20%). The texture of magnetite layers is strongly affected by S2. Magnetite grains are concentrated in thin films parallelised into the S2 foliation.  
Assemblages: Pre-D2: Srp + Mag + Ol + Ti-Chu. Syn-D2: Srp + Mag + Ol + Ti-Chu. Post-D2: Srp + Mag + Chl.
- Diopside**  
Pyroxenite. Clinopyroxene (70-80%), serpentine ± chlorite (10-20%), amphibole (5%), and ilmenite ± titanite (5%). Locally, magnetite, calcite, and apatite (<5%).  
Assemblages: Pre-D2: Cpx + Ap + Ilm + Srp + Chl ± Mag. Syn-D2: Cpx + Srp + Ttn + Chl ± Ilm. Post-D2: Amp
- Chlorite schist (b)**  
5 to 10 cm thick rim of mylonitic chlorite schist. Chlorite (60%), clinopyroxene (20%), serpentine (10-15%), ilmenite (10%), magnetite (2-3%), amphibole, and Ti-clinohumite.  
Assemblages: Pre-D2: Cpx + Chl + Ilm + Srp + Mag + Ti-Chu. Syn-D2: Chl + Cpx + Srp + Ilm. Post-D2: Chl, Amp.
- Pyroxenite**  
Layers and lenses wrapped and boudined into S2 foliation. Clinopyroxene (70-80%), serpentine ± chlorite (10-20%), ilmenite ± magnetite (5%), Ti-chondrodite + Ti-clinohumite (<5%), and amphibole (<2%).  
Assemblages: Pre-D2: Cpx (augitic core) + Spl + Srp (+ Ti-Chn). Pre-D2 to early D2: Cpx + Srp + Chl + Ti-Chn + Ti-Chu + Ilm + Mag. Syn-D2: Cpx + Srp + Chl + Ti-Chu + Mag. Post-D2: Srp + Chl + Mag + Amph.
- Dunites**  
Layers and lenses wrapped by and boudined into S2 foliation. Olivine (60-70%), serpentine (10-20%), magnetite ± Cr-magnetite (10%), chlorite (<5%), Ti-chondrodite + Ti-clinohumite (<5%), dolomite (<2%), and clinopyroxene (<1%).  
Assemblages: Pre-D2: Ol + Srp + Cr-Mag + Mag + Cpx ± Ti-Chn + Chl. Pre-D2 to early D2: Ol + Srp + Mag + Ti-Chu + Dol. Syn-D2: Ol + Srp + Mag + Ti-Chu. Post-D2: Srp + Cal.
- Ti-chondrodite + Ti-clinohumite veins**  
Ti-chondrodite + Ti-clinohumite (70-80%), olivine (10-15%), serpentine (5%), magnetite ± ilmenite (5%), chlorite (<5%).  
Assemblages: Pre-D2: Ti-Chn + ex-Spl + Ol + Srp ± Chl. Pre-D2 to early D2: Ti-Chn + Ti-Chu + Ol + Ilm + Mag + Chl + Srp. Syn-D2: Ti-Chu + Ol + Srp + Chl + Mag.
- Olivine veinlets**  
Ocher-yellow veinlets of few millimetres thickness. They are composed by olivine (90-95%), serpentine (10-15%), magnetite (5%). Veins are transposed by S2 foliation.
- Calcite veins**  
Post-D2 calcite.

**Symbols of mesoscopic fabric elements and orientation**

- Lithological surfaces with dip
- S1 foliation surfaces with dip
- D2 axial planes (AP2) and S2 foliation surfaces with dip
- D3 axial planes (AP3) with dip
- D3 folds axes
- Faults trajectory
- D1 axial plane trajectory
- S2 trajectory
- D3 axial plane trajectory
- D3 shear zones
- ~1972 Approximate topography contours

Datum: WGS84



**GEOLOGICAL FRAMEWORK**

a) Simplified tectonic sketch of the Western Alps with the location of the studied area (in the blue square). TP = Tertiary plutons; PL = Periadriatic Line; SL = Sesia-Lanzo Zone b) interpretative tectonic map of the upper Valtournanche (modified after De Giusti et al., 2003). The red star localises Crétón, the red rectangle circumscribes figure c. ZSZ = Zermatt-Saas Zone; CLU = Cignana Lake Unit (redrawn after Forster et al., 2004); PCB = Pancherot-Cime Bianche Unit; CZ = Combin Zone; DB = Dent Blanche nappe; c) outcrop structural map, modified after Rebay et al., (2018) and by Zanoni (unpublished: original mapping at 1:5000 scale) with the foliation trajectories in the meta-ophiolites of the upper Valtournanche (ZSZ). The red square localises Crétón outcrops. Relative chronology of successive foliation trajectories and rock types are specified in the legend. Topography redrawn from the technical map of the Val d'Aosta Regional Administration, without hydrography.