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Energy from Waste I / Management of Construction & Demolition Waste – Session VII

Petrography of Construction and Demolition Waste (CDW) from Abruzzo Region (Central Italy)

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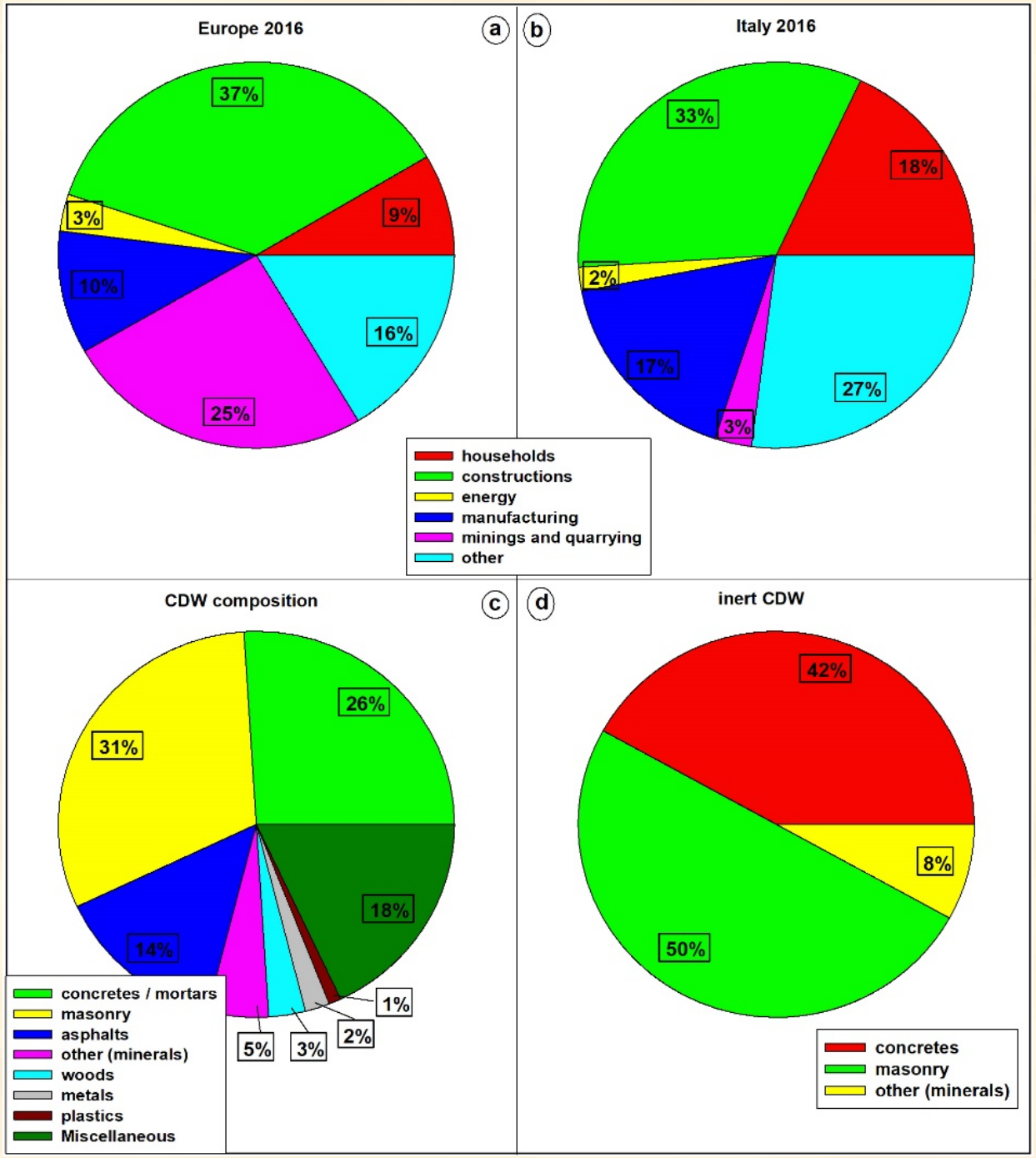
CDW are solid materials from civil engineering works, demolition, restoration and/or collapse (earthquakes, landslides, wars).

CDW are made of "ceramic-like" solids, plus asphalt, metals, plastics, textiles, wood, glass, RAEE, soils and/or dredging materials.



State of the art:

Low price materials for downcycling reusing (road and slab foundations, cavity fillings, etc.).

New materials with CDW have low quality and high variable mechanical properties, with poorly measurable and predictable behaviours.

CDW are made of silicate and/or carbonate phases, but their petrography (chemical, mineralogical and textural attributes) is poorly known, as well as heterogenous and mutable in time and space.

Petrography of CDW depends on available lithotypes (rocks), architectural and historical styles, as well as national regulations.

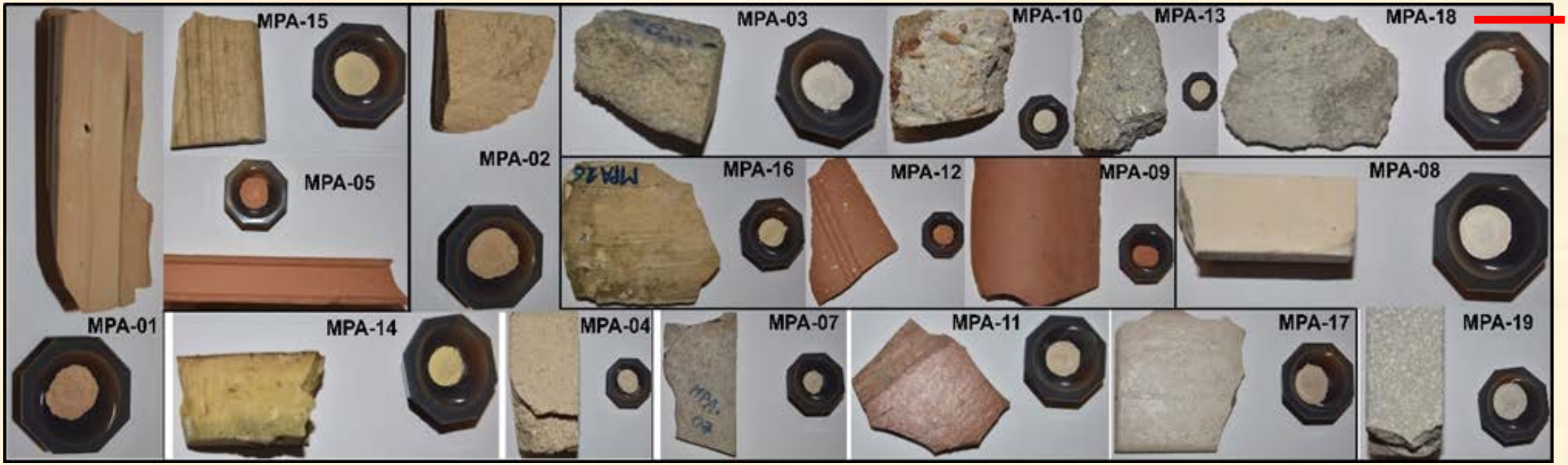
motivations:

petrographic characterisation of CDW from the Abruzzo region by mesoscopic, physical features, mineralogy (XRPD: X-rsay powder diffraction) and chemistry (XRF: X-ray fluorescence).

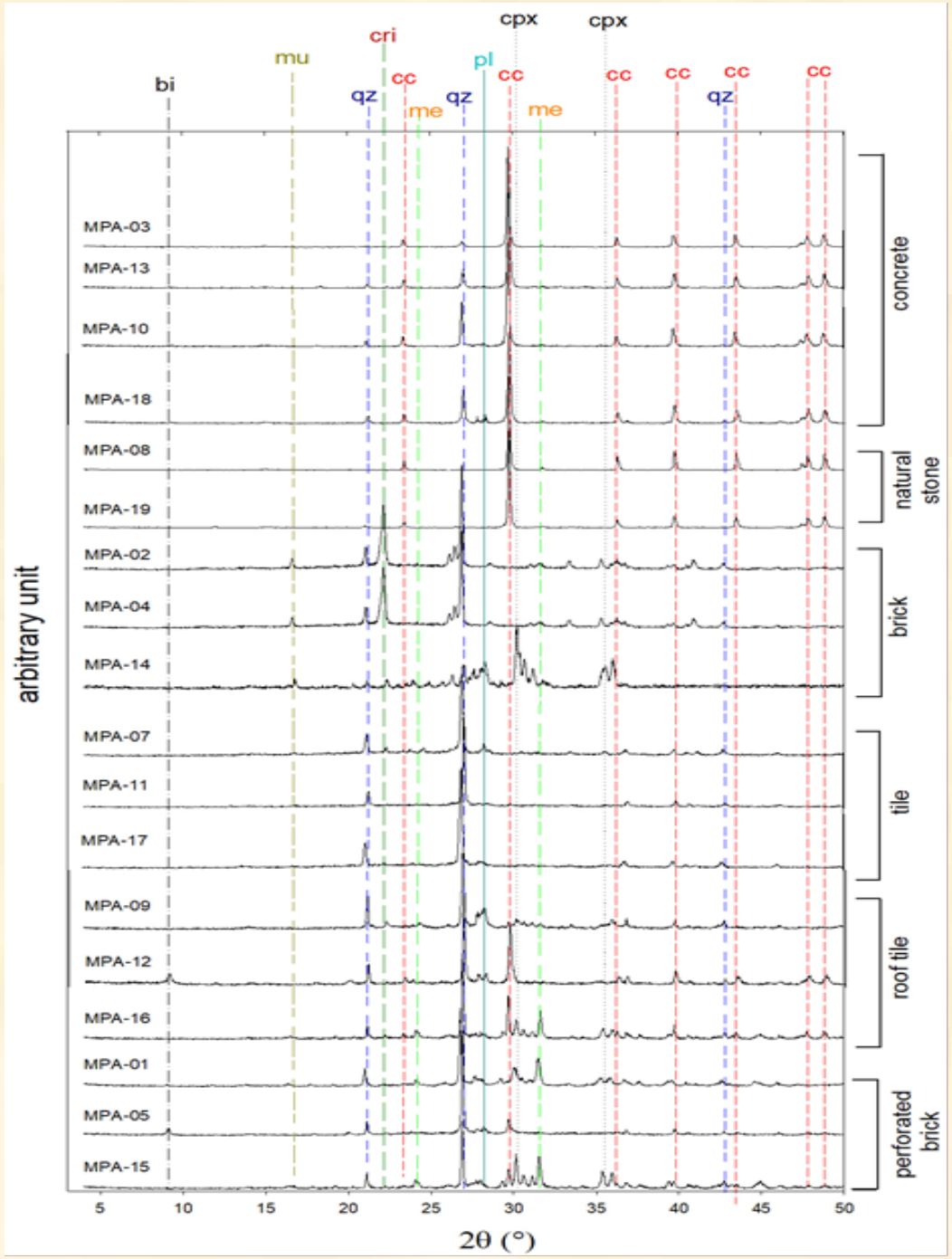
The Abruzzo region and its surroundings areas were hit by earthquakes in the last decades.

This region is representative of several other geographical and geological areas.

18 CDW samples:
4 concretes, 2 natural stones, 3 bricks, 3 tiles, 3 roof tiles and 3 perforated bricks

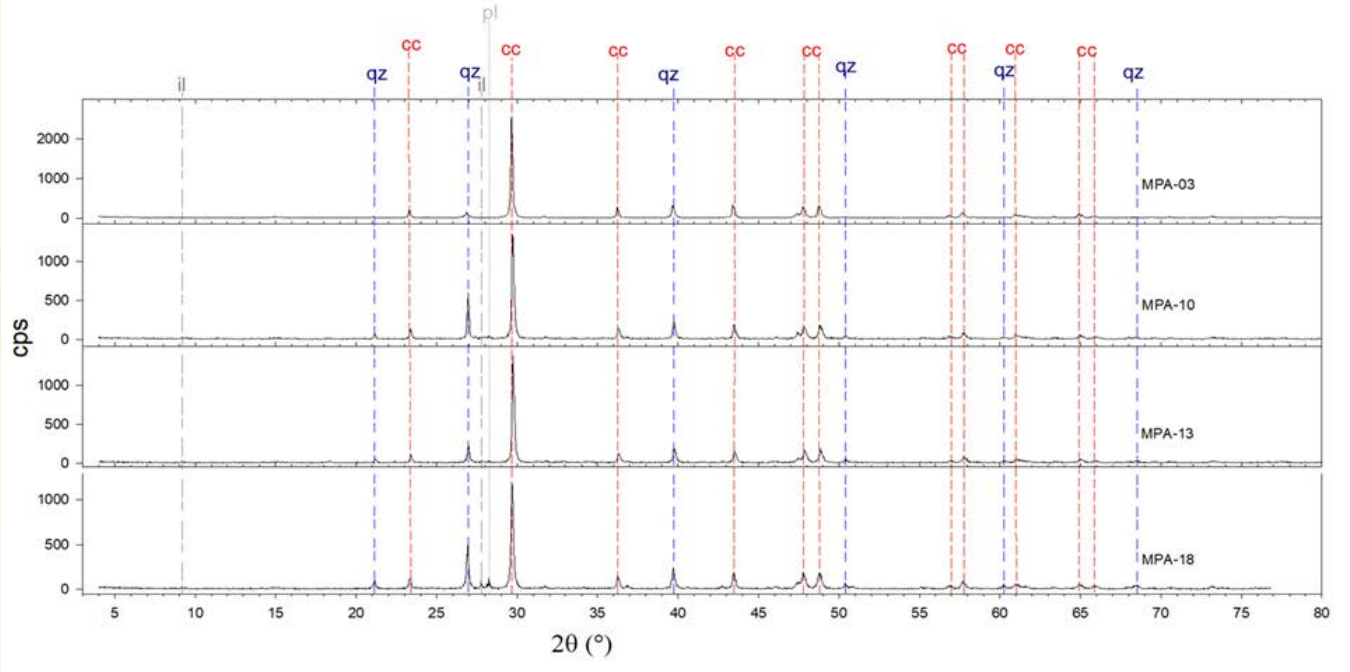


concretes and natural stones are whitish to grey and with density frequently > 2000 kg/m^3, whereas bricks, tiles, roof tiles and perforated bricks are coloured and generally < 2000 kg/m^3.

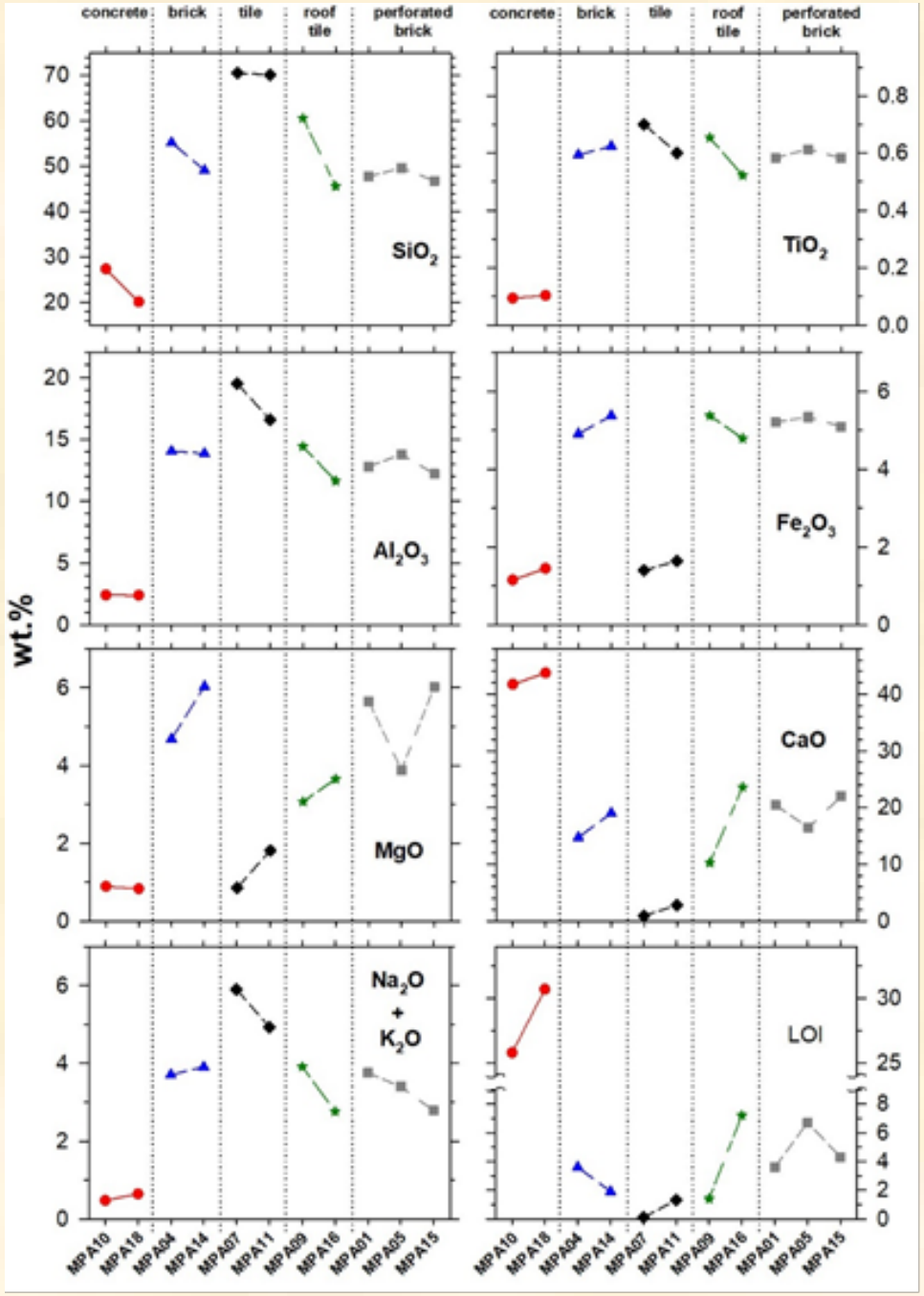


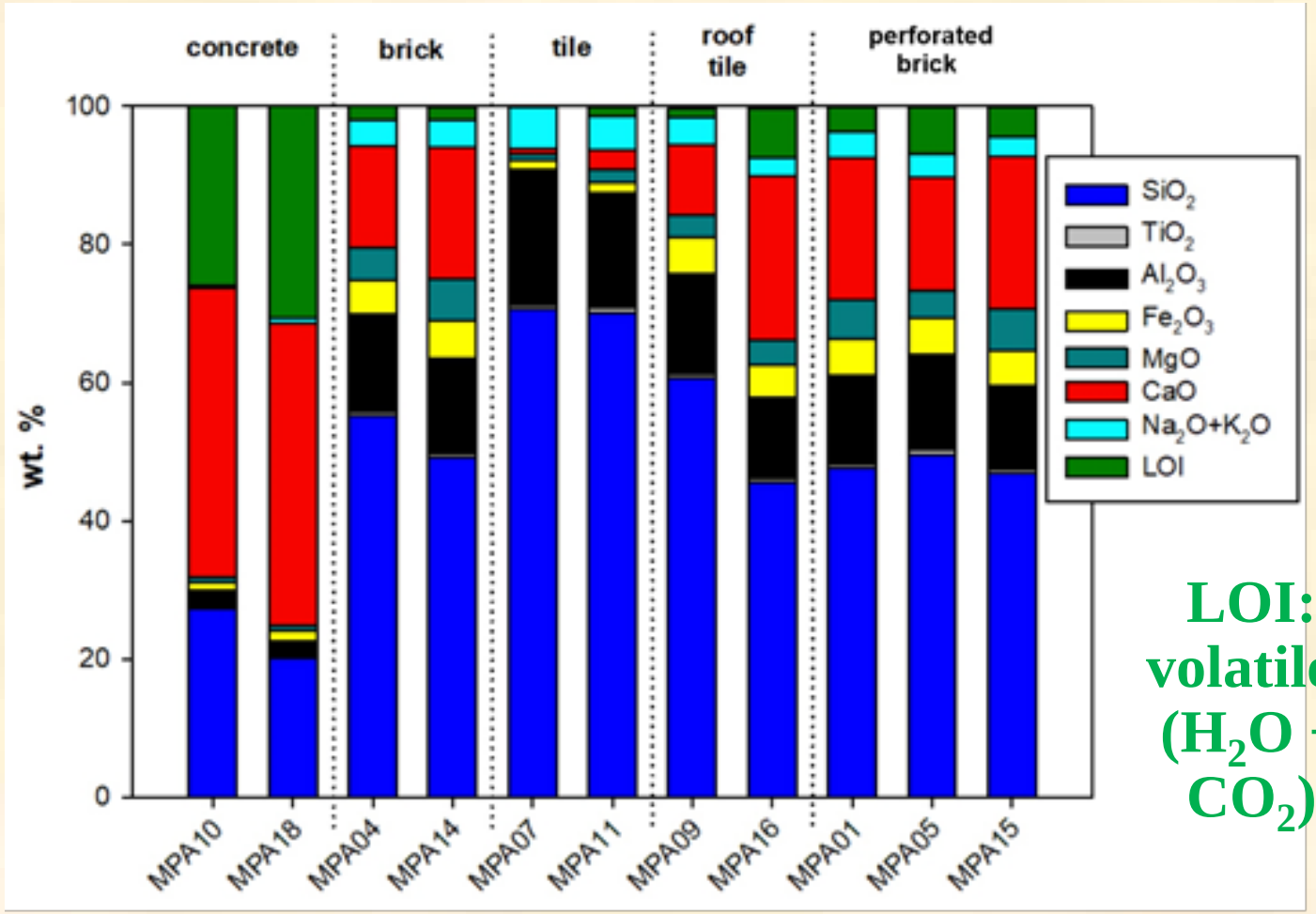
18 XRPD spectra:

cc: calcite, qz: quartz, cri: cristobalite, bi: biotite (sheet-silicate), cpx: clinopyroxene(chain-silicate), pl: plagioclase (feldspar), me: melilite plus glass



11 XRF analyses:
2 concretes, 2 bricks, 2 tiles, 2 roof tiles and 3 perforated bricks

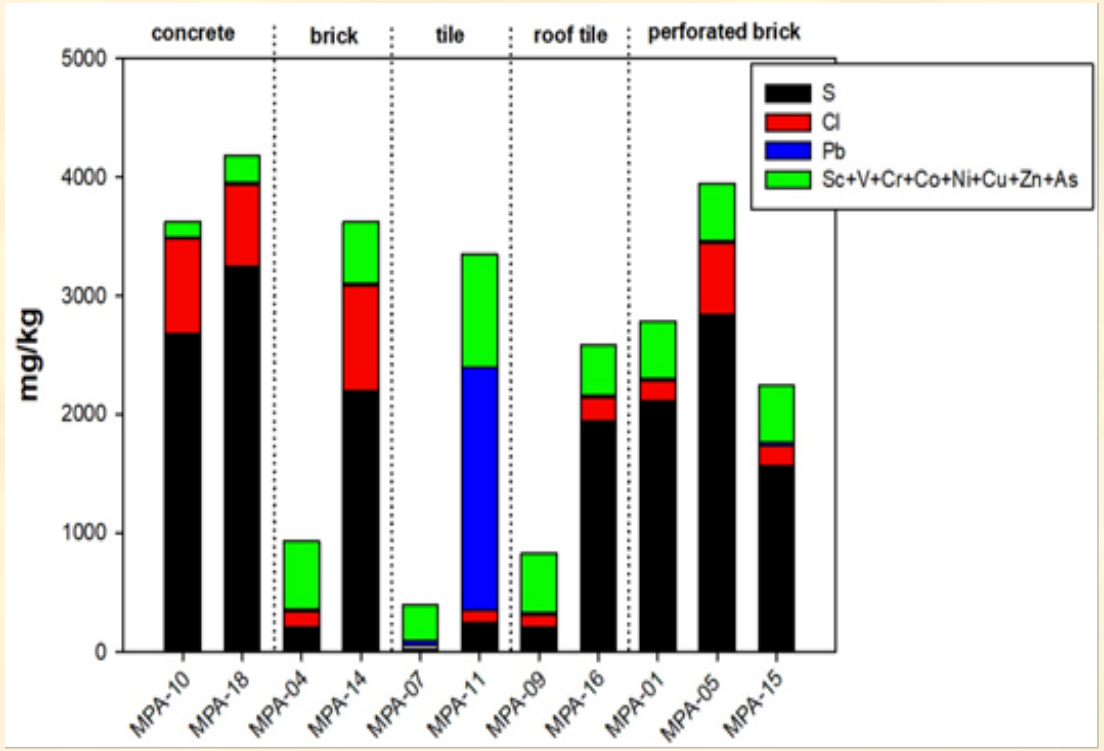


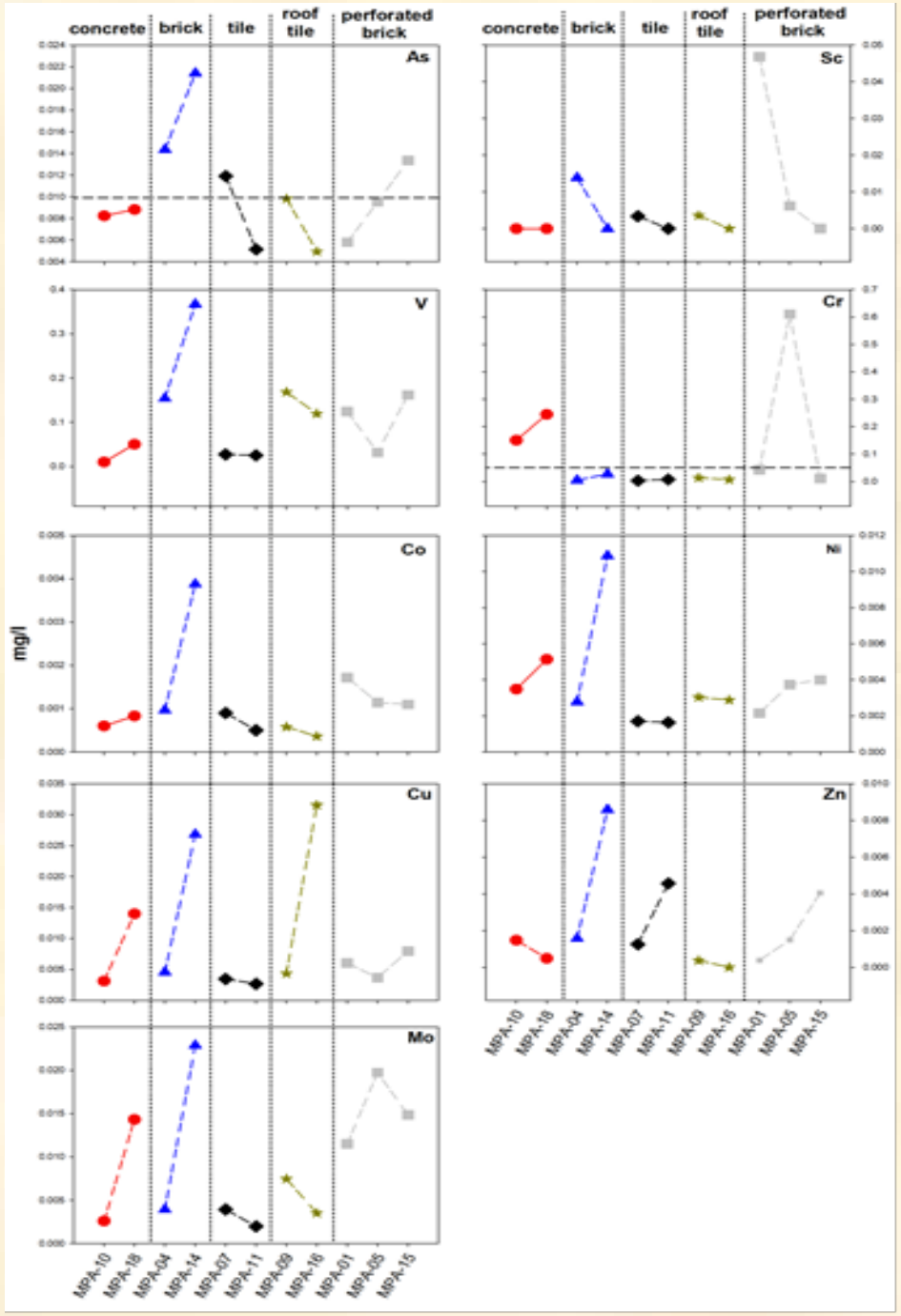


LOI: volatiles (H_2O + CO_2)

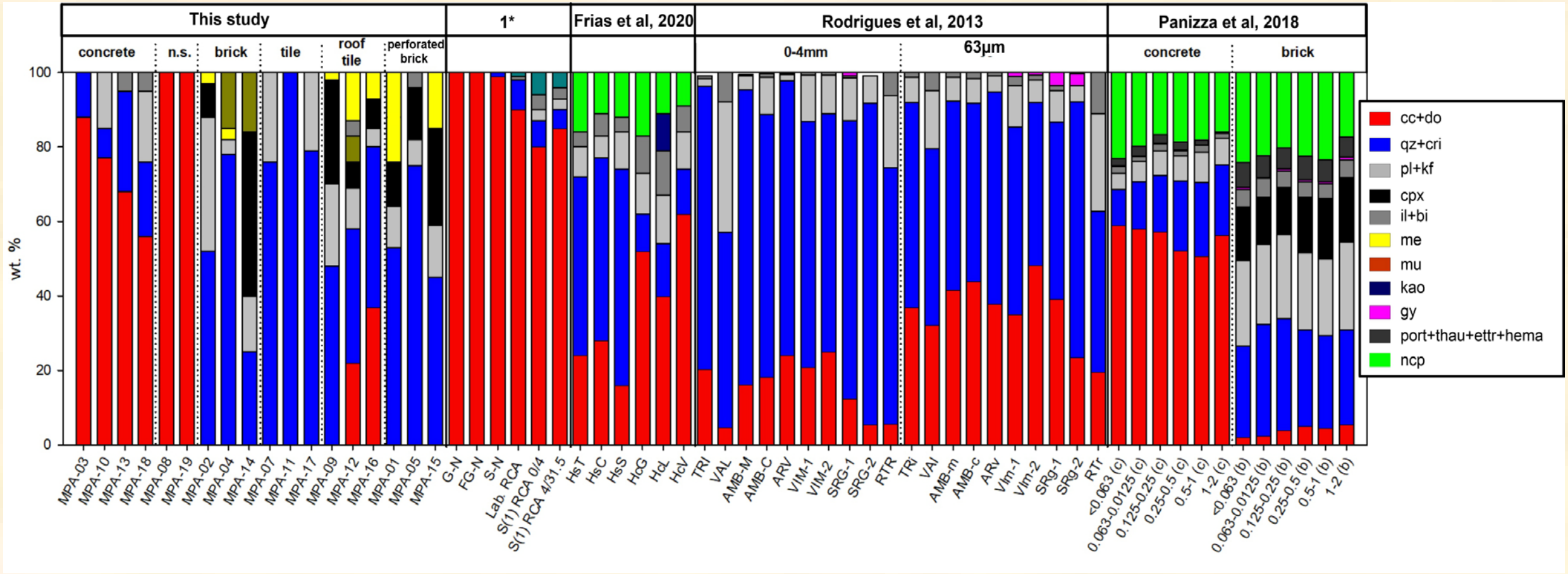
Contents of As, Sc, V, Cr, Co, Ni, Cu, Zn and Mo in leachates. The black dotted line indicates the Italian threshold values of Heavy Metals (TVHM)

Minor and trace elements in CDW types from Abruzzo





Crystalline and non-crystalline phases in CDW from different geographical/geological areas; carbonate minerals are the main aggregates of concretes in limestone-rich areas



Abruzzo Cnt. I

South Cnt. G

S

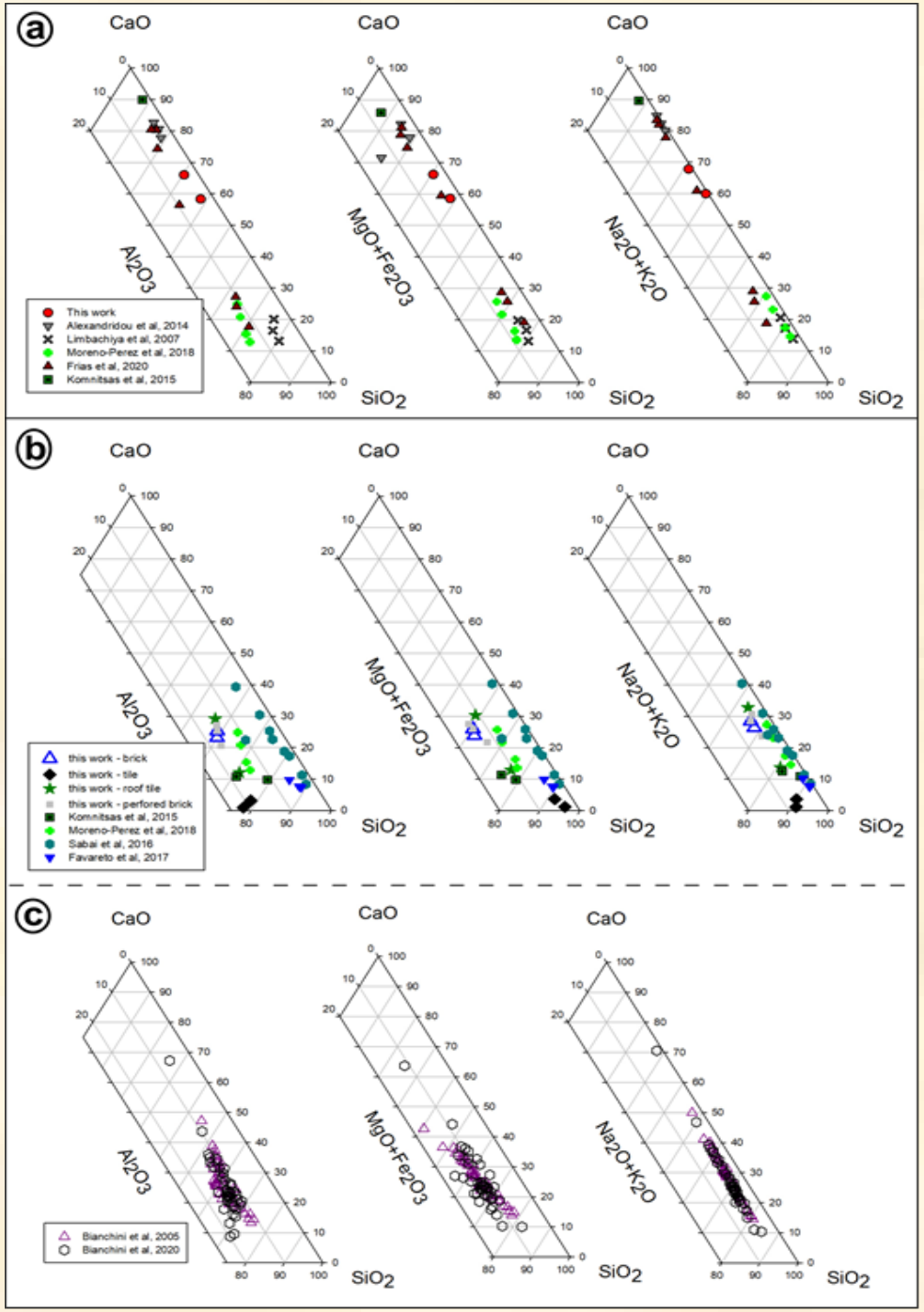
P

Veneto North I

Bulk composition of CDW

CDW of concretes and natural stones in limestone-rich areas (Abruzzo, Greece, etc.) are CaO- and CO_2-rich and SiO_2- and Al_2O_3-poor

regions poor in limestones and rich in silicate (sedimentary, igneous and/or metamorphic) rocks have instead concretes enriched in SiO_2- and Al_2O_3- and with abundance in masonry prepared with clay deposits (Po plain, Portugal, etc.)



Conclusions

The quantitative knowledge of petrography of CDW is the first step to perform a rationale and upcycling reusing

Abruzzo and similar geographical areas (Apennines, Dolomites, Greece, southern France, central Spain, Albania, ex-Jugoslavia, etc.) rich in limestones are characterised by abundant concretes and natural stones CDW made of carbonates, whereas limestones-poor regions are characterised by masonry and silicate-bearing concretes and natural stones.

Concretes and natural stones CDW composed of carbonate phases are whitish to grey, relative dense (> 2000 kg/m^3) and obviously rich in CaO and CO_2, are thus separable with (serial) physico-chemical sorting processes from masonry and silicate waste

Geology, petrography, mineral sciences, architecture and engineering know-hows are necessary to manage the upcycling reusing of CDW

thanks for your attention!