RESEARCH FIELD:
Sedimentary basin analysis

RESEARCH TOPIC:
Role of syndepositional tectonics and fluid flow over sedimentary body geometry, facies and diagenesis.

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RESEARCH DESCRIPTION:
Tectonics plays a fundamental role in controlling birth and evolution of sedimentary basins. In particular, fault activity results both in the generation of a topography that controls composition, facies and thickness of sedimentary bodies both in creating pathways for fluid uprise. These topics have been studied in two areas very different as to age of phenomena, geological setting, and fluid features. The first area is Monferrato where the Oligo-Miocene terrigenous sedimentary succession shows rock masses, from meter- to hundred meter-size, affectred by an anomalous cementation and in some instances also by the concentration of lucinid bivalves which in modern settings live close to places at the sea floor where CH_4-rich fluids are seeping. The degradation of these gaseous hydrocarbons is mediated bacterially and induces an increase in alkalinity. This in turn triggers the precipitation of carbonates (aragonite, calcite, dolomite) that show C-depleted isotopic values ($\delta^{13}C$ (from – 20 to -50 ‰ PDB).
The second area is in the Maritime Alps, in the Briançonnais and Dauphinois Domains. These consist of mainly carbonate successions of Mesozoic age. In the Marguareis Massif the tectonic control is documented by anomalous stratigraphic boundaries of Cretaceous marls over paleoescarpments developed over paleofaults where Triassic dolostones or Permian volcanic rocks were exhumed. In the Provençal Domain, the Triassic-Cretaceous successions show rapid facies changes from platform to slope environments and important hiatuses. Moreover, subvertical brecciated dolomite bodies, including saddle dolomite, occur which may be dated to the Early Cretaceous. This suggests a circulation along faults of hot fluids (150-200° on the basis of fluid inclusion analyses) that documents a deep origin of fluids and/or uncommonly high geothermal gradients. The latter could be related to the tectonic evolution of the distal part of the European continental margin to which the study area belonged.

LABORATORIES OF THE DST IN USE:
SEM-EDS, Rock sawing and preparation of samples for peels

RESEARCH PRODUCTS:

- CLARI P., CAVAGNA S., MARTIRE L. & HUNZIKER J. (2004) - A Miocene mud volcano and its plumbing system: a chaotic complex revisited (Monferrato, NW Italy). Jour.Sed.Res., 74, 662-676.
- PIANA F., MUSSO A., BERTOK C., D'ATRI A., MARTIRE L., PEROTTI E., VARRONE D. & MARTINOTTI G. (2009) - New data on post-Eocene tectonic

evolution of the External Ligurian Briançonnais (Western Ligurian Alps). Ital.J.Geosci. (Boll.Soc.Geol.It.), 128, 353-366.
- CLARI P., DELA PIERRE F., MARTIRE L. & CAVAGNA S. (2009) - The Cenozoic CH4-derived carbonates of Monferrato (NW Italy): a solid evidence of fluid circulation in the sedimentary column. Marine Geology, 265, 167-184.
- DELA PIERRE F., MARTIRE L., NATALICCHIO M., CLARI P. & PETREA C. (2010) - Authigenic carbonates in the Upper Miocene sediments of the Tertiary Piedmont Basin (NW Italy): vestiges of an ancient gas hydrate stability zone? Geol.Soc.Am.Bull., 122, 994-1010.
- MARTIRE L., NATALICCHIO M., PETREA C., CAVAGNA S., CLARI P., & DELA PIERRE F. (2010) Petrographic evidence of the past occurrence of gas hydrates in the Tertiary Piedmont Basin (NW Italy). GeoMar-Lett., 30, 461-476.
- BERTOK C., MARTIRE L.., PEROTTI E., D'ATRI A. & PIANA F. (2011) Middle-Late Jurassic syndepositional tectonics recorded in the Ligurian Briançonnais succession (Marguareis–Mongioie
- area, Ligurian Alps, NW Italy). Swiss Jour. Geosci, 104, 237-255.
- PEROTTI E., BERTOK C., D'ATRI A., MARTIRE L.., PIANA F. & CATANZARITI R. (2012). A tectonically-induced Eocene sedimentary mélange in the West Ligurian Alps, Italy. Tectonophysics, 568-569, 200-214.
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- NATALICCHIO M., BIRGEL D., DELA PIERRE F., MARTIRE L., CLARI P., SPÖTL C. & PECKMANN J. (2012). Polyphasic carbonate precipitation in the shallow subsurface: insights from microbially-formed authigenic carbonate beds in upper Miocene sediments of the Tertiary Piedmont Basin (NW Italy). Palaeogeogr. Palaeoclimat.Palaeoecol., 329-330, 158–172.
- BARALEL., BERTOK C., D'ATRI A., DOMINI G., MARTIRE L. & PIANA F. (2013). Hydrothermal dolomitization of the carbonate Jurassic succession in the Provençal-Dauphinois and Subbriançonnais Domains (Maritime Alps, North-Western Italy). C.R. Geoscience, 345, 47–53.

Fig.1 – *Moulds of bivalves (Lucina) in blocks of methane-derived marly limestones embedded within Pliocene mudrocks (Verrua Savoia, TO).*

Fig. 2 – *Clastic dykes and veins crosscutting hardly cemented sandstones (abandoned quarry at Alfiano Natta, AL)*

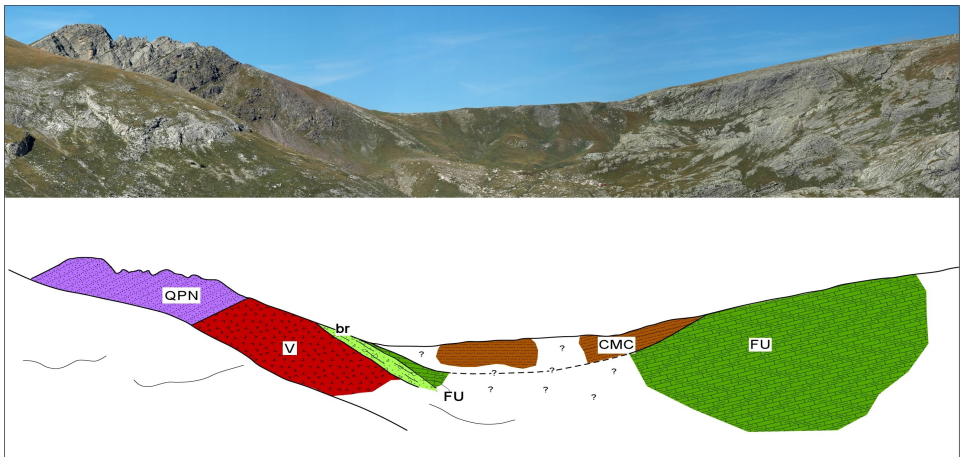

Fig. 3 – *Colle del Pas (Marguareis Massif, CN): Cretaceous (FU) and Eocene (CMC) sediments overlying Permian volcanic rocks (V) with an anomalous stratigraphic boundary marked by a thin level of sedimentary breccias (br). (QPN: Lower Triassic quartzarenites.)*

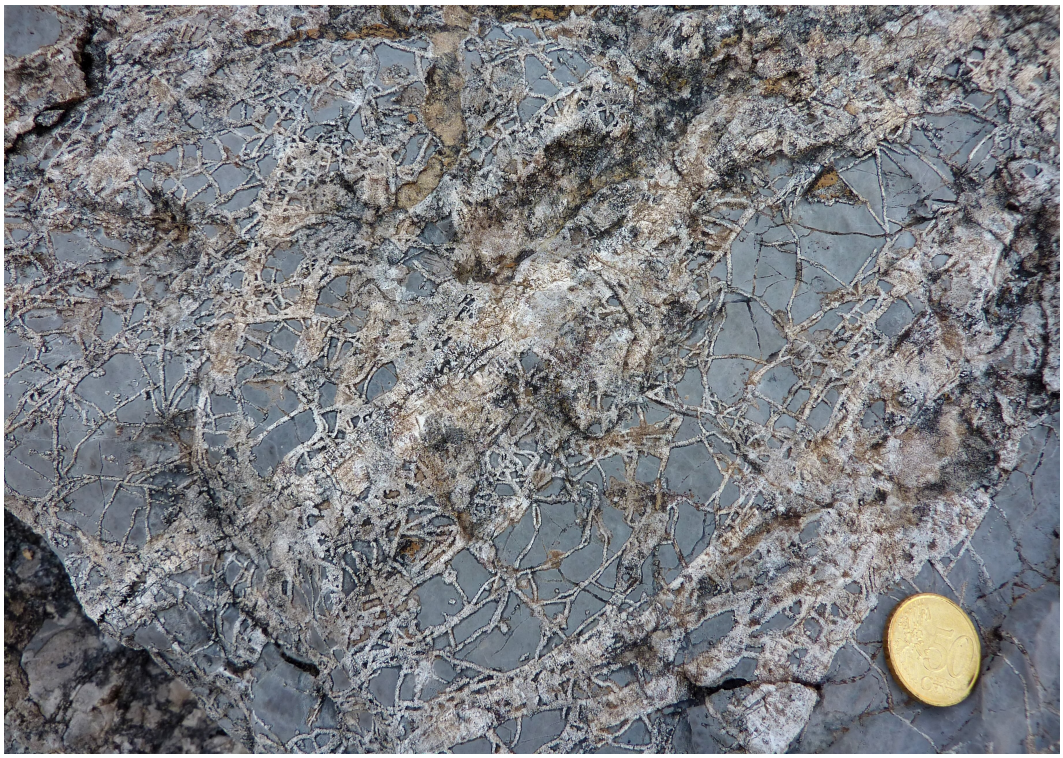

Fig. 4 – *Intensely fractured and brecciated Upper Jurassic limestones: the veins and the cement of breccias consist of dolomite. (Palanfrè, CN)*

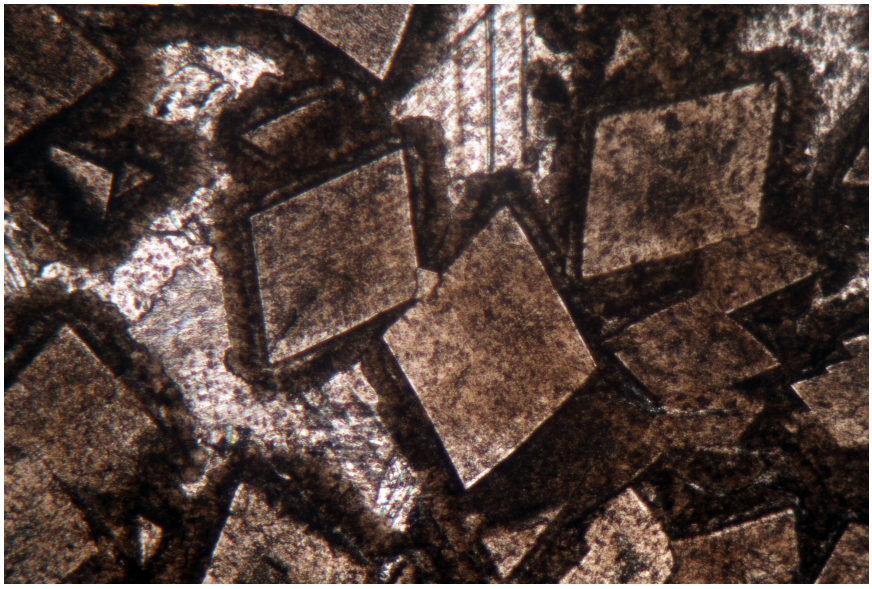

Fig. 5 – *Thin section photograph of the cement of the breccias of Fig. 4. Notice dolomite crystal zoning that documents different precipitation stages.*

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