Architecture and lithofacies of sillicoclastic turbidite systems:
From field outcrop to seismic integration

The turbiditic sedimentation is well-known since the 50's and the first pioneer works done by P.H. Kuenen and C.I. Migliorini that put in evidence the activity of deep-sea sediment transfer by density flows and the role played by turbidity currents in the deposition of deep-sea normally-graded sandy beds. Then, the observations made by A. Bouma in the early 60's in the tertiary Flysch of the Annot sandstones (Peïra Cava) became the standard model for turbidite analysis. Since the 70's, turbidite accumulations named "deep-sea fans" then "turbidite systems" have been widely studied for several reasons:

- modern turbidite systems can be up to 2000-m thick and participate strongly in the post-rift sedimentary construction of continental margins,
- they constitute a well-preserved and long-term sediment recording (archive) of phenomenon allowing reconstruction of the changes of climate, sea level and sediment supply, and reconstruction of the processes of sediment transport and deposition,
- because turbidite channels and levees clearly discriminate from their lithofacies that change from coarse- to fine-grained respectively, oil industry made also considerable effort to characterize these accumulations, as major hydrocarbon fields have been discovered within thick stacked channel-levee systems in the Gulfs of Mexico and of Guinea. In the Nile submarine delta (eastern Mediterranean), location of Pliocene gas reservoirs correlates with the presence of turbidite channels. It is thus important to understand the processes of construction of these sedimentary bodies through time and space and the factors controlling their construction. At sea, prediction of reservoir geometries is also a major challenge, particularly for deeply buried potential reservoirs that are not well imaged, even with the use of 3D seismic data. Analogue models could then help to partly solve this problem.

Construction of analogue models requires integrating information coming from the study of modern and fossil turbidite systems (morphology and spatial extension of sedimentary bodies, internal architecture of sedimentary bodies, horizontal and vertical distribution of lithofacies, porosity of coarse-grained deposits...).

During your training at the Villefranche-sur-Mer marine observatory, you will have the unique opportunity to study, compare and integrate data and observation coming from two areas separated by only 40 km: the modern Var turbidite system located in the Ligurian margin and the fossil Contes/Peïra Cava sandstone formation that is part of the Annot formation. The Var turbidite system and the Contes/Peïra Cava formation are both small-scale sand-prone systems that built on tectonically active margins. Seismic-reflection profiles collected at sea will image the internal architecture and Quaternary evolution of the Var turbidite system. Similar architectures will be observed on the field in the Contes/Peïra Cava area where outcrops will provide further information about facies distribution and processes of construction. From the Contes to Peïra Cava synclines, you will follow an interesting succession of architectures from proximal to distal turbidite environments including canyon-like structure, channel-levees systems and distal lobes, and their related siliciclastic deposits going through slumps, debrites, concentrated/hyperconcentrated flow deposits and of course turbidites. In the Peïra Cava syncline, the sinuous and narrow road of "la Baisse de la Cabanette" is also renowned for splendid sole marks including flute casts, groove marks, bounce marks and load casts.