An interdisciplinary approach to the Arno palaeochannels evolution since the X century BC in the Pisa coastal plain (Tuscany, Italy)

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A.Commodari[1], G. Sarti [2], M. Bini[2] and V. Rossi [3]
[1] Laboratory CEPAM (Cultures et Environnements, Préhistoire, Antiquité, Moyen Âge) - CNRS UMR 7264 University of Nice Sophia Antipolis, France. arianna.commodari@cepam.cnrs.fr
[2]Department of Earth science, University of Pisa, Pisa, Italy.
[3] Department of Biology, Earth and Environmental Sciences, University of Bologna, Italy

We have used a interidisciplinary approach involving archaeology, geomorphology, stratigraphy, sedimentology, chronology, history sources and archaeogeography to infer paleochannels evolution of the Arno River. The traces of a centuriation (a method of land division and assignment used by the Romans), are still identifiable in the plain and constitute an important benchmark that helps to recognize the phases of channel migration across the centuries.

A wide shallow subsurface data set mainly coming from MAPPA project (www.mappaproject.org), has been used as reference for stratigraphic correlations. The target of the research looks at the upper 8-10 m of the subsurface succession that dates back to the Iron Age. Two new cores, 9 m long, were drilled and sampled using a percussion drilling technique (Vibracorer Atlas Copco, Cobra model), which supplied smaller diameter cores, qualitatively comparable to standard cores. The description of cores lithofacies includes mean grain size, colour, sedimentary structures and accessory materials (shells and fragments; peat horizons or decomposed organic-rich layers; plant debris; wood fragments and calcareous nodules). Facies analyses, archaeological data, and historical sources, have allowed: i) the identification of a paleo-Arno river branch, likely Roman in age, which flowed southernmost with respect to the present-day course and ii) the evidence of significant processes of meanders migration.
Moreover, this data opens up new prospects regarding the relationship between the evolution of the Arno River, in the coastal plain area, and the centuriation created by the romans.

Application of rock formation simulation technology to exploring formation mechanism of deep clastic reservoir

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Jinggang Cui[1,2], Zhiyong Gao[1,2] and Jiarui Feng[1,2]
[1] Research Institute of Petroleum Exploration & Development, Petroleum Geology Research and Laboratory Center
[2] State Key Laboratory of Enhanced Oil Recovery

Deep into the Kuqa depression in the Tarim Basin, fractured reservoir of sandstone has developed. Sandstones of different grain sizes have gone through an evolution of rock formation, starting from the early stage of long-term, shallow burial to the late stage of rapid, deep burial. Development of this type of fractured reservoir may be connected with the difference in size of deposited particles. Hence, we conducted a diagenesis modeling experiment concerning influence factors of particles of different sizes under lithostatic pressure.

To exclude the influence caused by natural difference between grains of different sizes from the experiment, we selected fine (70-100μm) and medium grains (30-40μm) of artificial quartz sand as samples. We filled the sample of each group, weighing 100g, into the sample tube. The simulated depths and their lithostatic pressures in the experiment are as follows: 1000m=27.5MPa, 2000m=55MPa, 3000m=82.5MPa, 4000m=110MPa, 5000m=137.5MPa, 6000m=165MPa. Then we put the tubes into the reaction vessel of the reservoir rock formation simulation system. When the experiment was finished, we cast the samples with solidification fluid and put them on slides. After that, we observed, appraised and compared the slides under microscope. We found that under different lithostatic pressures, particles of different sizes but same accumulation pattern revealed two types of rock formation features. Under simulation conditions, in the shallow and medium-depth reservoirs, i.e. within the range of 1,000-4,000 meters, clatic accumulation of fine particles was tighter than that of medium particles; in the deep reservoirs, i.e. within the range of 5,000-6,000 meters, the tightest accumulation pattern was broken, particles were deformed under pressure, and the larger the particles, the more likely they are to be broken.