Fold growth in the South Caspian Sea Basin: Mechanisms and interaction with deep-water lacustrine sediments

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The South Caspian Sea Basin contains one of the thickest sedimentary successions of any basin on the planet. It has accumulated up to 10 km of sedimentary infill in the last 6 Million years alone, overlying a thick, organic-rich, over-pressured shale. The location of the Caspian Sea at the site of a major zone of plate convergence between the Arabian and Eurasian Plates, has led to the formation of numerous shale-cored anticlines, with associated mud volcanoes. Since c. 3 Ma it has been isolated from marine waters and sedimentary fill has been dominated by fluvial and deltaic deposits passing laterally into shallow and deep-water lacustrine sediments in the south of the basin.

This aims of this project are firstly to investigate the mode of formation of the shale-cored Caspian Sea Basin folds and in particular address the role of sediment loading as well as tectonic shortening in their genesis; and secondly to understand how the deep-water lacustrine environments are affected by the growth of the folds. Recently acquired 3D seismic reflection data over the Shafag-Asiman fold structures (figure below), affords a unique opportunity to address these scientific questions.

Classically shale-cored detachment folds of the type found in the Caspian are thought to form only in response to tectonic shortening. Those in the south Caspian Basin are attributed to ongoing shortening across an underlying accretionary prism where oceanic crust of the South Caspian Basin is being subducted beneath the North Caspian Basin. However the input of large volumes of sediment entering the basin may also have contributed to fold growth by the gravitational loading of the weak underlying shale. This hypothesis will be tested by calculating growth-rate indices and shortening for the folds followed by numerical modelling with Rockfield finite element code.

The second part of the project will investigate the deep-water lacustrine sediments that were deposited as the folds were forming. Preliminary work in the study area has demonstrated the presence of numerous deep-water lacustrine (figure to right) channels that suggest sediment supply from was not just from the Palaeo-Volga in the north but also from the other surrounding rivers. Deep-water lacustrine sediments are very poorly understood and studied and this project affords an excellent opportunity to increase our knowledge about potential hydrocarbon reservoirs in such rocks.

We are looking for an earth science graduate with a first class degree and a strong skill set in structural geology and sedimentology; previous experience of seismic interpretation and/or numerical modelling would be an advantage. The student will join an active research team at Imperial working on structural development and sedimentation in deep-water fold and thrust belts.

To apply: Please contact Lidia Lonergan (l.lonergan@imperial.ac.uk) and include a CV, with your course grades with your email. The closing date for applications is 31 January 2017. The project will be funded either through a college NERC or departmental scholarship (UK nationals only). Overseas students with other sources of funding are also welcome to apply.