Where has the Tethyan lithosphere gone after consumption by the Alpine-Carpathian orogeny?

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In the general scenario of plate tectonics, the outer rigid shell of the Earth is consumed along convergent plate boundaries. This consumption translates into downward movement of the lithosphere into the mantle. This involves almost the full thickness of the lithosphere in case of oceanic subduction, and probably most of the continental mantle lithosphere in case of a continent-continent collision. In the Alpine-Mediterranean area, regional P-wave tomography has shown that subducted lithospheric fragments accumulate in the mantle transition zone beneath most of Europe (e.g. Piromallo & Morelli, JGR, 2003).
Here we present new images of the main mantle discontinuities (nominally at 410 and 660 km) bounding the transition zone beneath the Carpathian-Pannonian region. The ~35 km station spacing of the ~1.5 year Carpathian Basins broadband seismology project deployment along three NW-SE arrays, together with the permanent stations in Hungary and surrounding countries, provide a good 3-D coverage of the transition zone beneath this region, and achieve higher resolution than previous seismological studies there. We process the dataset to enhance P-to-S converted waves (receiver functions), which are then migrated to depth to obtain the 3D image of the discontinuities. The so-called '410' and '660' interfaces, which are in general related to phase changes in olivine, appear clearly. The measured depths show evidence for a transition zone thicker than the global average, which is attributed to the presence of cold material, consistent with the tomographic images. Moreover, below the eastern part of the Pannonian Basin, we determine that the '660' interface is further depressed by at least 15 km. Our interpretation is that this anomalously deep phase change may reveal the initial stages of further downwelling of cold subducted material into the uppermost lower mantle, advecting the phase change surface downward. Similar depression of this phase change is observed beneath some of the currently active oceanic subduction zones.

New insights into the Oligocene to Miocene evolution of the Austrian deep water Molasse Basin: implications for facies distribution and hydrocarbon exploration

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The understanding of the detailed geological evolution of the Molasse Basin is crucial for the continued success of exploration in this mature basin. Risks associated with play types can be better assessed considering their evolutionary framework. Results from several research projects increase the understanding of stratigraphic traps by characterising the sedimentological processes that control them and help to find new play types.
Several studies, focussing on the sedimentological and stratigraphic architecture, have been concluded in recent years or are still ongoing. This presentation will give an overview of the objectives, results and implications of these initiatives for evaluation and analysis of the geological evolution and for exploration of the Molasse Basin.
An initial collaboration with Stanford University integrated sedimentological core analyses with 3D seismic, wireline log data interpretation and outcrop studies in analogue settings. The study yielded a modern sedimentological model for the Upper Puchkirchen Formation which was subsequently applied to exploration.
A sequence stratigraphic study examined the sequence framework of the Molasse Basin fill and was able to correlate 5 sequences from the shelf into the deep basin. Studies on seismic and core analyses from the south slope of the Puchkirchen trough show how slope morphology and confinement control sediment distribution in the southern slope deposits. The transition from deep to more shallow marine conditions and the progradation of deltaic sequences into the basin in Eggenburgian/Burdigalian times is described by an intense 3-D seismic interpretation in combination with sedimentological core work. Working on a more local scale, other projects are improving the understanding of the detailed architecture of distinct play elements such as the Upper Puchkirchen Channel or the Basal Hall Formation Channel.
In general, these studies highlight the complex interaction of processes that control sediment distribution in the basin. Morphology, tectonics, sediment input and sea level changes all contribute to the sedimentary architecture of the deep water basin. Continued research needs to detail the interactions in order to enhance trap prediction for continued exploration success.

Reassessing seismic-slip values and potential seismogenic fault areas in the Vienna Basin: implications for seismic potential

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The Vienna Basin Transfer Fault (VBTF) is a slow moving active fault passing through the most populated and most productive region of Austria and Slovakia. Recent activity is indicated by moderate seismicity (I_{max} ~ 8-9, M_{max} ~ 5.7), quaternary geology (tilted fluvial terraces and fault-controlled Peistocene basins) and geomorphology (linear scarps with hanging valleys). The purpose of this study is to use and discuss different data sets that constrain the seismic potential of the Vienna Basin Transfer Fault (VBTF). Seismic slip values corresponding to the seismic energy release are calculated from an earthquake catalogue spanning the Austrian and Slovakian part of the VBTF in the vicinity of the Vienna Basin (ACORN 2004). A 3-D model of a generalized VBTF in the area of the Vienna Basin is constructed. Segmentations from recent geological interpretations are used to define potential rupture zones on the generalized fault. The seismic slip for the VBTF from Semmering to Dobra Voda is in the range of 0.22 – 0.31 mm/yr, assuming a seismogenic fault thickness of 8 km. Calculating the slip rates for individual fault segments shows, that the rates vary significantly between the segments, from virtually no seismic slip to values as high as 0.77 mm/yr (Dobra Voda segment). Comparing these data to GPS derived velocities (> 1 mm/yr, Grenerczy et al. 2005) show, that the fault yields a significant seismic slip deficit. Segments of the fault with apparently no seismic slip contrast from segments which might be locked. The modeled fault surface areas within the seismogenic zone (4-14 km depth range) of the VBTF vary from 55 km^2 to more than 400 km^2, with segmentation information partly still incomplete. Using these areas with empirical observations (Wells & Coppersmith 1994) confirms, that the areas are sufficiently large to explain