Faziesanalyse der obereozänen bis unteroligozänen "Cixerri-Formation" im Becken von Narcao (SW-Sardinien)

FREITAG, H.* & SCHÄFER, A.**

*Geologisches Institut der Universität zu Köln, Zülpicher Str. 49a, D-50674 Köln, **Geologisches Institut der Universität Bonn, Nussallee 8, D-53115 Bonn, heiko.freitag@uni-koeln.de, schaefer@uni-bonn.de

Mit Hilfe verschiedener Parameter ist versucht worden Rückschlüsse auf die diagenetische Entwicklung des Beckens von Narcao, sowie der dort Abgelagerten "Cixerri-Formation" zu ziehen.
Bei der obereozänen bis unteroligozänen "Cixerri-Formation" handelt es sich um eine kontinental entwickelte Fazies, deren Hauptverbreitungsgebiete sich im wesentlichen auf Südwest Sardinien, die Sulcis (Narcao-Becken), Iglesiente (Cixerri-Tal) und dem östlichen Rand des Campidano-Grabens beschränken.
Im Hauptuntersuchungsgebiet dem Becken von Narcao läßt sich die "Cixerri-Formation" in zwei unterschiedliche fluviatil-lakustrische Fazieseinheiten untergliedern, die eine Gesamtmächtigkeit bis ca. 200 Meter erreichen können. Zum Hangenden hin wird sie durch oligozäne Vulkanite überlagert (andesitische bis trachytische Laven sowie Pyroklastika).
Im östlichen bis nordöstlichen Beckenteil befindet sich die Feinklastischefazies und im westlichen bis südwestlichen Beckenteil die Grobklastischefazies. Beide Einheiten werden einem alluvialen Schwemmfächer mit einer von N-NE nach S-SW verlaufender Paläoströmungsströmungsrichtung zugeordnet.
Das sich so darstellende Bild läßt sich nur mit Hilfe der regionalen Geologie und der regionalen Tektonik erklären, da ansonsten die Paläoströmungsrichtung nicht mit den Ablagerungsbedingungen übereinstimmen würde.

Geodynamic sedimentology - interrelations between sedimentation and tectonics

FRISCH, W., KUHLEMANN, J., DUNKL, I., BRÜGEL, A. & SPIEGEL, C.

Geologisches Institut, Universität Tübingen, Sigwartstrasse 10, D-72076 Tübingen, frisch@uni-tuebingen.de

There is manifold interrelation between the sedimentary record, especially of clastic sequences, and tectonic processes which take place in the source region of the sediment. An active orogen is a highly appropriate area to study these interrelations. Synorogenic clastic sediments like flysch or molasse can provide important information about the evolving mountain chain, especially when they have not been thermally overprinted. We like to focus on the young, post-collisional history of the Alps, in order to highlight appropriate procedures for the reconstruction of paleogeological, paleotopogaphic and paleogeodynamic settings during the uplift stage of the orogen from information stored in the sedimentary record. This period was characterized by large-scale tectonic movements due to continuing thrusting, lateral escape of blocks, and extensional tectonics, as well as by a complex uplift (and thus erosion) history. Syntectonic sediments derived from the Alps are widespread and are found from the Rhone delta to the Black Sea and from the North Sea to the Apennines. The information stored in these sediments is largely destroyed in the orogen.

Sediment mass budgets steered by tectonic processes
Precise sediment mass budgets of the circum-Alpine basins are able to give valuable information on the erosional history of the orogen. Together with the exhumation history in the orogen, as derived from thermochronological studies, tectonic processes can be constrained. An example from the Tauern window in the Eastern Alps shows that the great part of the Miocene exhumation of the window was performed by tectonic rather than by erosive denudation. Large-scale extension led to pull-apart of the rigid Austroalpine orogenic lid in the order of 170 km, which enabled rapid exhumation of the Penninic strata below. Sediment mass balances reflecting the erosion in the Alps and reasonable assumptions on erosion rates in the areas outside the exhuming window lead to the conclusion that erosion contributed only by about 20 % to the denudation of the window, which is in line with an independent tectonic reconstruction. During Miocene exhumation of the Lepontine dome in the Central Alps, the part of erosion was in the order of 30-40 %.
Sediment mass budgets in combination with provenance studies of detrital material can contribute to the reconstruction of river catchment areas and thus to changes in the position of water divides. In the Eastern Alps, the rearrangement of the river system due to a tectonic revolution in late Early Miocene time and the gradual northward shift of the main Alpine water divide from south to north from Late Miocene times on can thus be reconstructed. In the Swiss Alps, there are two abrupt shifts of the water divide, which are revealed by antagonistic changes in sedimentation rates north and south of the Alps. Such abrupt shifts must have their roots in tectonic events, probably they are connected to fore- and backthrusting.
In a first approximation, a simple relationship can be established between orogenic-scale tectonic movements and syntectonic sedimentation. Orogenic contraction will lead to crustal thickening and surface uplift, enhanced erosion and sedimentation, orogenic collapse will result in the opposite procedures. However, other factors like processes affecting the lithospheric mantle, may have severe effects on uplift and erosion. A mid-Oligocene event caused doubling of the synorogenic sedimentation rate and was responsible for the first buildup of large fluviatile fans with coarse gravel in in the Molasse zone, reflecting a marked surface uplift event in the Alpine body. The climate-induced mid-Oligocene sea-level drop is not able to explain these phenomena, all the more so as the onset of coarse clastic sedimentation shows a gradual shift over several Ma from west to east. A possible explanation for this event, with which the modern history of mountain building in the Alps started, is slab breakoff, which is probably also reflected by the Periadriatic magmatism. Thus, isostatic, geomorphological, and sedimentary response to crustal thickening could only become effective after breakoff of the heavy subducting slab.
The orogenic collapse in the Eastern and Central Alps in Early and Middle Miocene times is reflected by a drastic decrease in the erosion and thus sedimentation rates. Pliocene increase in the sedimentation rates cannot be directly related to known tectonic or other processes but may be the result of conversion of eclogitic into less dense material in the deeper crust causing surface uplift and enhanced erosion. Lowering of the timber line due to climatic changes may have contributed to the increase of erosion. Strongly enhanced erosion in Quaternary times, in contrast, is clearly the climatic signal of the ice age.
The actual erosion rate in the Eastern Alps is around 0.18 mm/a and was about twice that value during glaciation. The interrelation of Pleistocene glaciation, uplift and erosion/sedimentation is not well understood. While glaciation and deglaciation will cause oscillating isostatic response, glaciation must have caused increased erosion and thus a permanent isostatic effect resulting in net lowering of the average elevation. An average removal of about 600 m by Pleistocene erosion, as revealed by sediment budgeting in the formerly glaciated areas of the Eastern Alps, would result in a decrease in the average elevation of about 100 m. However, summits with very low erosion rates would then experience uplift of up to 500 m due to the isostatic response. Elevation of the summit level and overdeepening of the valleys led to relief enhancement and slope steepening thus reinforcing erosion. Present surface uplift corresponds with thick crust (mostly >45 km), Pleistocene glaciation, and rugged and high relief, and thus with high erosion