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Die Geologie des Lauterbach Gasfeldes

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Das Gasfeld Lauterbach liegt in der österreichischen Molassezone an der oberösterreichischen - salzburgischen Landesgrenze. Strukturell handelt es sich um ein Piggyback Becken in der Oberen Puchkirchen Serie (älteres Miozän), das über den Schuppen der teilweise überschobenen Vorlandmolasse der Alpen entstanden ist und eine stratigrafische Falle darstellt („isolated basin fill“). Das Becken hat eine Längserstreckung von 5,5 km und eine Breite von ca. 4 km, die Sedimente der Beckenfüllung ereichen Mächtigkeiten von ca. 500 m (COVAULT et al. 2009). Die Hauptschüttungsrichtung der Sedimente ist nordgerichtet (Sedimenteintrag von Süden). Die Produktion erfolgt aus 5 teils isolierten, teils verbundenen Sandlagen mit wechselnden Mächtigkeiten von 10-40 m und Ausdehnungen von 4 x 3,5 km bis 2 x 1 km. Der Gas-Wasser Kontakt liegt bei ca. 800 m.
Ziel dieser Arbeit soll es sein, die Entstehung und Verteilung der turbiditischen Beckensedimente zu verstehen, deren Ausdehnung möglichst exakt zu ermitteln und die gewonnenen Erkenntnisse in einem statischen 3-D Model zusammenzufassen. Das Beckenmodel beruht auf der Interpretation von 3-D seismischen Daten, Kerndaten und den Bohrlochmessungen der 12 in das Becken und dessen Umgebung abgeteuften Bohrungen.
Um die Struktur und Ausdehnung von Sandkörpern in einer sehr komplexen Wedge-top Depozone, für die das Lauterbach Becken ein Beispiel ist (COVAULT et al. 2009), erfassen zu können, ist es unerlässlich, die Prozesse die zur Ausbildung der vorliegenden Beckengeometrie und Sedimentverteilung geführt haben zu verstehen: Erosion („sediment bypassing“) und (synsedimentäre) tektonische Deformation. Diese beiden Faktoren stehen in ständiger Wechselwirkung während der Bildung des Beckens und führen zu der komplexen vorliegenden Situation. Da die Korellation der verschiedenen Turbiditabfolgen anhand charakteristischer Logmuster schwierig und irreführend ist, bieten Druckdaten eine wichtige Hilfestellung. Die seismische Interpretation ist ebenso herausfordernd, da die teilweise geringmächtigen Sedimentpakete unter der seismischen Auflösung liegen. Seismische Attribute (z. B. Variance) erleichtern die Kartierung größerer Sandkörper, zeigen allerdings kaum Erfolg bei Lagen mit geringer Mächtigkeit und begrenzter lateraler Ausdehnung.
Die Charakterisierung einer Lagerstätte in einer komplexen Wedge-top Depozone erfordert eine methodenübergreifende Interpretation aller vorhandenen Daten mit Berücksichtigung der beiden Hauptfaktoren Erosion und synsedimentärer Deformation, ebenso wie eine genaue sedimentologische Betrachtung des vorliegenden Turbiditsystems. Druckdaten aus Bohrungen und die zugehöringen Bohrlochmessungen ermöglichen eine wichtige Verfeinerung der seismischen Interpretation und geben Aufschluss über vorliegende Verbindungen der produzierten Horizonte.

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On the age of the Eisenkappel granites

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The Eisenkappel pluton crops out in the eastern Karawanke mountains in Austria and Slovenia along a belt to the north of the Periadriatic line. It is composed of mainly granites and diorites and minor gabbro, monzonite, and granodiorite (VISONA & ZANFERRARI 2000). Based on mineral age date done in the mid-70s, an early Triassic intrusion age was postulated (e.g., CLIFF et al. 1975, SCHARBERT 1975). In order to improve on these data, we dated zircons from 7 samples and titanite from one sample by U/Pb LA-ICP-MS at Xi’an and amphiboles and biotites from 4 samples, and K-feldspars from 5 samples by the Ar-Ar method at Salzburg University.
One diorite samples (with very small zircon grains) from Slovenia gave U/Pb ages between 450 and 500 Ma. Zircons from the main rocks of the Karawanke pluton (biotite granite, granodiorite, amphibole granite) often show a spread of data points along the concordia with a maximum between 280 and 300 Ma and a smaller cluster at about 240-250 Ma. The titanite gave ages of about 245 Ma.
The Ar-Ar dating yielded ages between 245 and 260 Ma for amphiboles from granitic rocks and an age of 235 Ma for a K-rich amphibole from a gabbro. Biotites gave ages of 245 Ma, 242 Ma, and 232 Ma for granitic rocks, and 228 Ma for biotite from the gabbro. K-feldspars show patterns with increasing ages with high-temperature gas release steps. The ages reach (pseudo)plateaus of about 170-180 Ma, reliable low-temperature release steps are at about 70-80 Ma.
We draw the following main conclusions from the presented ages:
(1) There is an Ordovician magmatic event preserved in the Karawanke belt.
(2) The time of intrusion of the main Eisenkappel granitoids is between 280 and 300 Ma, i.e. of early Permian age.
(3) The spread of U/Pb zircon ages along the concordia

down to about 245 Ma points to elevated temperatures up to the end of the Permian. This is also supported by the U/Pb titanite age and Ar-Ar amphibole ages; the latter confirming cooling below ca. 550 °C between 260 and 245 Ma.

(4) Cooling below 300 °C (biotite ages) occurred in the Middle Triassic.

(5) K-feldspar Ar-Ar ages indicate cooling below ca. 250 °C in mid-Jurassic time and probably some reheating in the Cretaceous.

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Ar-Ar ages of detrial mica from rivers draining the Qilian Shan on the NW margin of the Qaidam basin

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Our study of Ar-Ar ages of detrital white mica from Eocene to Pliocene successions of the Qaidam basin shows almost exclusively ages with 250±3 and 279±3 Ma in the northeastern part of the basin (RIESER et al. 2006), in contrast to a dominance of mainly early Palaeozoic ages in its western part. As no nearby source of these Indosinian ages is known so far, we dated mica from rivers draining the Qilian Shan between Delingha in the SE to Dachaidan in the NW in order to assess the Qilian Shan as a possible source. All sample locations are northeast of the early Palaeozoic UHP-belt running along the basin margin. Direct access to the Qilian Shan for collecting samples is very restricted and no Ar-Ar ages from this mountain range are published until now. Confirmation or rejection of an Indosinian belt in the Qilian Shan would have implications for both the geodynamic evolution of the area and filling models of the Qaidam basin.

We dated white mica (175 grains) and biotite (45 grains) from six rivers that drain the mountain ranges south of the drainage divide to the Danghe and the Qinghai Hu. Pooling all white mica ages gave minimum and maximum ages of ca. 175 Ma and ca. 1300 Ma, respectively. There are 3 significant groups in the age distribution with median ages of 190 Ma, 255 Ma and 425 Ma, with a minor peak at about 380 Ma. Their proportions are ca. 15 %, 30 % and 45 %, respectively. The rivers show marked differences in their age distributions. 2 samples from the Ar Gol at Delingha, which drains the eastern part of the range, show 2 groups with ages of 250 and 430 Ma. The Hiagtin Gol, which drains the middle part of the range, displays the same age groups, but their medians are shifted to somewhat younger ages. There are also a number of ages between 300 and 400 Ma, though they display no distinct peak. The rivers at and north of Dacaidan show extremely different age distributions: The Iqe river, which drains a large portion of the northern range, display only one age group with 425 Ma, two small catchments to the south and to the north of the Iqe river gave each one age group too, but with median ages of 190 Ma and 255 Ma, respectively.

These white mica ages indicate two main thermo-tectonic events in the Qilian Shan, a Silurian and a Permo-Triassic event. The significance of the early Jurassic ages needs further investigations, as these ages are from a very small area only and the type of source rocks is unknown so far (metamorphic or magmatic). The Silurian („Caledonian“) age group is well known from the area (Qinling, Qilian, Altyn) and related to an orogenic cycle from subduction to continental collision. Indosinian ages are obviously substantial, as they make up a considerable part of the age population and occur in rivers draining a major part of the range. Therefore we propose an Indosinian orogenic belt running within the southern Qilian Shan.

Regarding filling models of the Qaidam basin, the occurrence of Indosinian ages in the Qilian Shan allows a local derivation of the sediments in the eastern part of the basin. A big difficulty for a provenance solely from the Qilian Shan are the missing Caledonian ages in the whole Tertiary sedimentary sequence in the eastern part of the basin.

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Changes in ostracod assemblages during the onset of Lake Pannon (Styrian Basin)

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The clay pit Mataschen (near Fehring/Styria) gives an exceptional insight to the onset of Lake Pannon during the Early Late Miocene. Due to the uplift of the Carpathian mountain range, the Central Paratethys became restricted to the Pannonian Basin. Within the Pannonian Basin a vast brackish to successively freshening waterbody - known as Lake Pannon - was established.

An extensive multidisciplinary research campaign in 2004 led to a very detailed picture of the evolution of the section at Mataschen. The c. 30 m thick section represents a complete transgressive-regressive cycle bearing insects, molluscs and vertebrates as well as plant fossils like leafs,