

flat-ramp-Detachment) gelang es, durch Serienschritte die komplexe Internstruktur einer Transferstörungszone erster Ordnung im Detail aufzulösen. Darüberhinaus ergibt sich die Möglichkeit, die Reaktivierung bestehender Schwächezonen unter kompressiver Beckeninversion zu beobachten.

Die Petrofazies der karbonen Hochwipfel Formation der Karawanken (Österreich/Slowenien)

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In den österreichischen und slovenischen Karawanken sind nicht oder nur schwach metamorphe paläozoische Serien aufgeschlossen. Die Folgen des Oberordoviz bis Unterkarbon zeigen die klassische Entwicklung eines passiven Kontinentalrandes auf. In Folge der variszischen Ereignisse änderte sich ab dem mittleren Visé die geotektonische Situation. Der Sedimentationsstil änderte sich diachron zu einer Flysch-Sedimentation (Hochwipfel Formation), die winkeldiskordant von karbonatischen und siliziklastischen flachmarinen Ablagerungen des Stefan überlagert werden. Diese werden allgemein als Molassebildungen interpretiert.

Mit Hilfe eines sedimentpetrographisch - geochemischen Untersuchungsansatz soll der Stoffbestand der Hochwipfel Formation untersucht werden und daraus die Provenanz der Sedimente, sowie die geotektonische Entwicklung des Beckens abgeleitet werden. Die rechtslaterale Seitenverschiebungszone des Periadriatischen Lineaments teilt die Karawanken in eine nördliche und eine südliche Einheit. Die nördliche Einheit entspricht der Fortsetzung der nordalpinen Gailtaler Alpen. Die südliche Einheit wird als morphologisches und orographisches Äquivalent der Karnischen Alpen betrachtet und entspricht diesen weitgehendst in ihrer geologischen Struktur und Deformation. Paläozoische Abfolgen treten als nach Süden einfallender Faltungs- und Überschiebungsgürtel nördlich und südlich des Periadriatischen Lineaments auf.

In den östlichen Karawanken ist der größte Anteil der karbonen Hochwipfel Formation in der Gegend des Seeburg Sattels aufgeschlossen. Die Sedimente der Hochwipfel Formation weisen Sedimentstrukturen und andere Merkmale auf, die auf Ablagerung in einem, sich schnell vertiefenden, Becken hindeuten. Der Detritus

wurde von dem entstehenden Faltungs- und Überschiebungsgürtel, sowie von gehobenen metamorphen und magmatischen Gesteinen des Hinterlandes geliefert. Einschaltungen tuffitischer Aschenlagen geben Hinweise auf gleichzeitigen Vulkanismus.

Unsere petrographische Studien zielten zunächst auf die Identifikation und Unterscheidung der detritischen Körner, sowie deren graphischer und statistischer Auswertung.

Danach lassen sich innerhalb der Hochwipfel Formation aufgrund des detritischen Modalbestands vier Petrofazies-Typen unterscheiden (Abb. 1).

Petrofazies 1 ist aus Lithareniten, mit einem durchschnittlichen detritischen Bestand von $Q_{50}F_{10}L_{35}$, zusammengesetzt; Petrofazies 2 besteht aus Lithareniten mit einem durchschnittlichen detritischen Bestand von $Q_{45}F_{10}L_{45}$; Petrofazies 3 beinhaltet Litharenite bis feldspatreiche Litharenite mit einem durchschnittlichen Modalbestand von $Q_{65}F_{10}L_{25}$; Petrofazies 4 setzt sich aus feldspatreichen Lithareniten zusammen und zeigt einen durchschnittlichen detritischen Bestand von $Q_{75}F_{10}L_{15}$. Die vier Petrofaziestypen können in eine Lithoklast-reiche und Feldspat-arme Gruppe und in eine Quarz-reiche und Feldspat-reiche Gruppe zusammengefasst werden.

Beide Gruppen können verschiedenen geographischen und stratigraphischen Situationen zugeordnet werden und stellen räumliche, sowie zeitliche Änderungen der Provenance innerhalb der Hochwipfel Formation dar.

Alpian history of the Great Caucasus from the point of view of lithologist

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Study of geological structure and geological development of the Great Caucasus has a long history and its development was investigated in frames of a geosynclinal theory.

Re-interpretation of the lithological data with the use of the achievements of modern sedimentology has allowed to consider new by a history of development and environment of sedimentation within the Great Caucasus, to draw a boundary between continental and oceanic sectors, to explain a difference of structure of northern and southern slopes of the Great Caucasus.

Alpine cycle began from formation of a marginal sea as a result of spreading, where in early Jurassic took place an accumulation of sandy-clayey deposits of the Sinemurian - Lower Pliensbachian. Further development of the sea transgression brought to the overlapping by sea of substantial part of craton and during early and middle Jurassic deposited fine mainly clayey material. That has stipulated an accumulation of classical black shale formation in conditions of extensive and sufficiently deep-water basin. In the limit Pre-Caucasus were accumulated shallow marine terrigenous sediments; on the border of these areas are installed subsea apron and gravity mass flow deposits.

On the boundary of early and middle Jurassic the activation of spreading brought to thinning or even breakup of continuous pre-Alpian basis, that on its turn has stipulated intensive underwater tholeiite basaltic volcanism, appearance of diabase dykes, and somewhere to the formation of spilite-keratophyre with complex ore mineralization.

In the late Jurassic - early Cretaceous increased contrast of subaqueous relief of sea floor, more clearly are isolated shelf, continental slope and deep-water basin. On the northern shelf were formed shallow water carbonate sediments, somewhere with evaporites, on the edge of shelf - reefs, but on the slope below and on its foods - carbonate turbidites. South border of this shelf was locate approximately on the place of modern Rocky Ridge.

Such differentiation of basin on the depth and presence of whirl

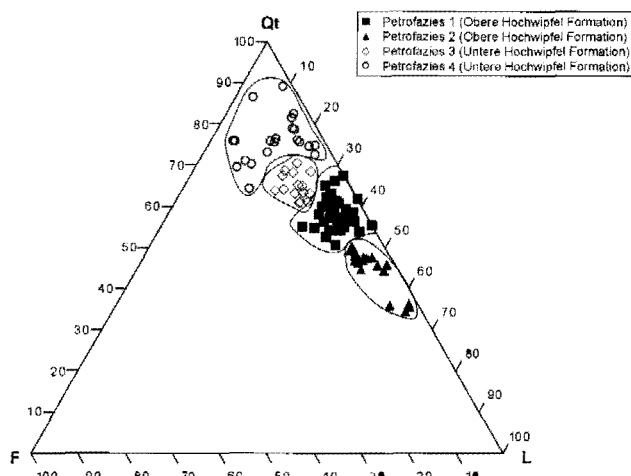


Abb. 1: QtFL - Diagramm der Sandsteine der Hochwipfel Formation

Abb. 1: QtFL-Diagramm der Sandsteine der Hochwipfel Formation

slope existed to the second half of Paleogene, as far as on the slope and its foots lasted a flysch formation. Outside of dependencies from paleogeographic position existed a regional background composition formations. Shallow water terrigenous deposits are located on the shelf of the Hauterivian - Albian and on the continental slope it is a terrigenous flysch. Upper Cretaceous is submitted on the North by planktonogenic formation of chalk, but in the South - by carbonate flysch.

The setting apart of the Great Caucasus basin from one of the Lesser Caucasus and differentiation of former united deep-water basin began in the Eocene as a result of subduction and closing of Tethys. That led to the forming of a row of half isolated basins. In the Oligocene here began forming a lower marine molasse.

From the end Miocene appeared a subaerial relief, height and contrast of which progressively increased, including - with the late Pliocene - and to the account of volcanic activity. This has stipulated a forming of rough upper molasse. Moving the hard masses from the South has stipulated the lifting of oceanic and slope sediments, partial underthrusting of them under Epi-Hercynian platform, that led to the forming of mountain - folded structure and intensive overland volcanism. Herewith in mountain building were involved areas of former shelf and shallow marine sediments became now lifted on the height of 3 - 3,5 /1. within modern Rocky ridge. As a result the section of northern declivity of Great Caucasus is packed by shallow marine shelf deposits, but southern - by deep-water deposits of continental slope and its foots. Different style in tectonic of northern and southern slopes of the Great Caucasus - folded with overturning folds southward on the South and monoclinical-cuesta on the North, unmeasured higher degree of metamorphism on the southern slopes in contrast with northern is stipulated by movement of a hard mass from the South and accordingly lateral pressure.

Paleogeographical types of the carbonate sediments of the Pre-Caspian depression

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Pre-Caspian basin is one of the most deep depression of the Globe. In Paleozoic apparently with the Ordovician to the end of the early Permian, it was developed as a deep-water basin - a microocean, which to the beginning the Kungurian was practically isolated from the World ocean and deep-water basin was filled by Kungurian salts.

Carbonate sedimentation in the depression and on its setting began in the late Devonian and lasted with small breaks to Artinskian age inclusive. Three paleogeographic types of carbonate formation are installed - shelves, isolated shoals and reefs.

1. On west and north surrounding areas are developed three thick carbonate complexes upper Frasnian - Tournaisian, middle Viséan - Bashkirian and middle Moskovian - Artinskian, which are divided by terrigenous complexes of the lower Viséan substage and Vereiskian horizon of the Moskovian stage. Here wide-spread shallow-marine bentogenic carbonate sediments of the humid or more often arid zones, with thickness from 250-300 to 900-1000 m. They are presented by limestones, less dolomite sometimes with evaporites. On the more narrow eastern shelf develop two shallow-marine carbonate complexes upper Viséan - Bashkirian and upper Moskovian - upper Carboniferous each with thickness of 500-700 m, divided by terrigenous strata with the thickness 350-500 m. On the most narrow southern-western shelf is located upper Viséan - Asselian shallow-marine carbonate shelf formation with total of thickness near 1000 m.
2. Within the Pre-Caspian microocean among deep-water

bituminous-siliceous carbonate-clayey sediments is discovered several isolated carbonate platforms, the most studied of them are Astrakhan. Its roofing is disposed on the depths 3900-4100 m. Carbonate deposits with the thickness near 2000 m have the upper Devonian - Bashkirian age. Sizes of platform approximately 150x175 km, and its elevation above the sea floor reached 1000 m.

3. The third paleogeographic type of carbonate sediments are reefs. Three types of reefs are established:

- an asymmetric reef system, surrounding edge of shelves of different age. Different types of shifting reef systems of different age in compare to each other are installed. Progradation of reefs towards depression is predominated, but there is also inverse shifting, moreover there are cases, when in one time in one parts of the slope occurs progradation, but in other - regradation

- shelf reefs of the Serpukhovian and lower Permian age, usually small on areas and height. Distinctive, that shelf reefs develop in sharply arid zones, in the composition which dominate dolomite, but often are presented also evaporites.

- intrabasin reefs. The most studied examples are Tengiz and Karachaganak. Sizes of atoll-like reef Tengiz is approximately 17x23 km. It is packed by two carbonate deposits of the upper Devonian - Tournaisian and upper Viséan - Bashkirian age, total thickness more than 3500 m. Height of reef was 1200-1500 m. Reef Karachaganak in the Viséan - Bashkirian was developed as an atoll by the size 15x30 km, but after the long hiatus (middle - late Carboniferous) in early Permian as a dome-like comparatively isometric reef with dimension of 12-5 km. Total thickness of reef exceeds 2000 m, and its height reaches 100-300 m.

Sharp cessation of development of isolated carbonate platforms and intrabasin reefs or long-term break of forming last is connected with anoxic events in the deep-water basin, which led to the disappearance of carbonate-precipitating including reef-building organisms. Hereinafter area of possible carbonate sedimentation are rendered in aphotic zone and accumulated here only deep-water sediments.

It is installed that depths of Pre-Caspian consecutively increased from 250-300 m at the late Tournaisian to at least once 2000-2200 m to the beginning Kungurian.

Neptunian dykes and cavities in drowned platforms: opening and filling mechanics. Selected Jurassic examples from Tata Hill (Hungary) and Monte Kumeta (W. Sicily)

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Neptunian dykes are common in Jurassic carbonates of the Tethys region. Two localities belonging to different paleodomains were studied; in both places the neptunian dykes and associated dissolution cavities formed primarily during times of break up of large carbonate platforms. Observations of the dykes and cavities lead to several interpretations for their origin.

Tata. Three major cavity types were observed around the Tr/J drowning unconformity surface, in the top section of the Tr Dachstein Lst. and in the covering Liassic pelagic section (Fülöp 1975, Mindszenty 1992, Haas 1995). These are the following: 1/ Karstic dissolution cavities in the Tr host. 2/ Neptunian dykes cutting the Tr as well as the lower part of the Liassic series. 3/ Bed parallel cavities (stromatactis-like structures) in particular levels of the Liassic succession. The dykes can be grouped into parallel