bezug auf ihre anwendungsbezogenen Eigenschaften, sowie der Suche nach neuen, verbesserten Materialien.

Wichtig ist das Erkennen und Verstehen von Struktur-Eigenschaft-Korrelationen, sodass eine vertiefte strukturelle Analytik eine wesentliche Grundlage darstellt. Eine weitere Bedingung ist das Verständnis der physikalischen Effekte und der Funktionsweise der Produkte.

Beispiel 1: Energiespeicherung in Li-Ionenbatterien. Li-Mn-Spinelle und Graphit werden als Li-Interkalationsmaterialien in diesen Batterien eingesetzt. Die Interkalationsprozesse selbst, die Diffusionspfade des Lithiums und mögliche Phasenumwandlungen sind im Detail noch nicht ganz verstanden. In-Situ-Strukturanalytik in elektrochemischen Zellen soll tiefergehende Einblicke in die Elektrodenprozesse gewähren.

Beispiel 2: Energiewandlung in einer Brennstoffzelle. Der Einsatz von Perowskiten in Festkörperelektrolyt-Brennstoffzellen erfordert Materialien mit sowohl elektronischer Leitfähigkeit als auch Ionenleitfähigkeit. Diese physikalischen Eigenschaften sind stark von Stöchiometrieabweichungen und Symmetrieerniedrigung der kubischen Perowskit-Grundstruktur abhängig. Strukturelles Monitoring in der Massenproduktion hilft in der Qualitätssicherung.

Beispiel 3: Energiewandlung in einer Solarzelle. Die Entdeckung neuer Halbleitermaterialien resultiert aus einem interdisziplinären Forschungsansatz zwischen Mineralogen, Physikern und Elektrochemikern. Die Gruppe der Sulfosalze (Abb. 1) erwies sich als vielversprechende Kandidaten für Halbleiteranwendungen in Solarzellen, Peltier-Elementen und Röntgendetektoren.

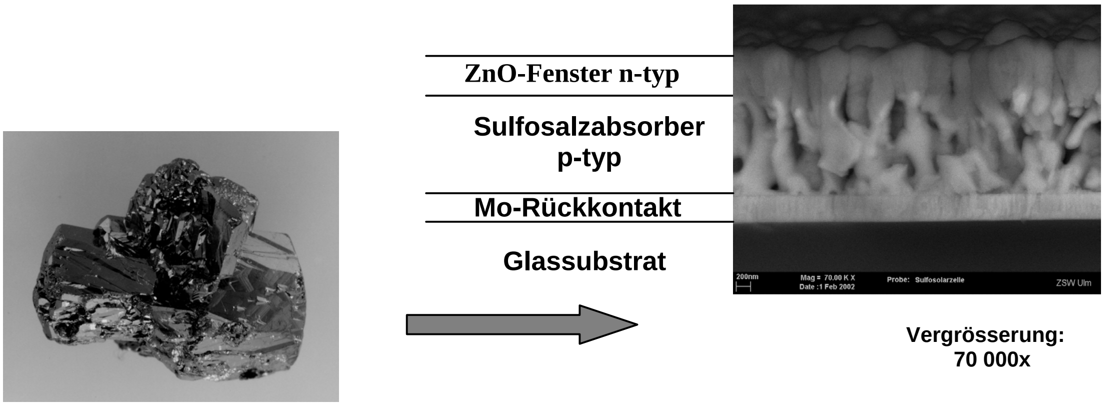

Abb. 1: Von der Mineralstufe zur Sulfosalz-Solarzelle

Spring pits related to cylindrical, vertical ground water channels

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The limited fresh water resources of our planet are facing steadily increasing human and industrial consumption, as well as various threats by chemical, radioactive and biological pollution. With increasing difficulties in the exploration of new groundwater resources in future, the knowledge about groundwater processes and spring formation will increase in importance. In this investigation, active under water springs in a Himalayan lake are compared with cylindrical, vertical water channels and spring pits from a Lower Devonian barrier-island environment; both, the active and the fossil example are explained by up-welling artesian ground water.

Several circular depressions have been found on the bottom of a small lake in the Lingti Valley, NW Himalaya (India). Ongoing activity is indicated by boiling-like movement of a fluidized sediment water mixture in central parts of the spring pits. Ground water flow towards the valley center in high porosity alluvial fan material underneath lake mud causes a relatively raise in hydrostatic head that results in channelized up-ward flow of water and the formation of circular spring pits.

Numerous cylindrical structures cross-cutting stratification perpendicularly in Lower Devonian barrier island arenites from the northwestern Himalayas represent channels for upward flow of ground water. Pipes initiated from a relative thin horizon; their upper termination formed spring pits. Rapid rise in relative sea-level possibly caused a rapid rise in ground water seepage, resulting in the formation of springs. Due to the minor relief in this environment, the sea level rise affected a relatively large area and cylindrical structures can be found in widely separated sections.

In both examples, artesian ground water formed spring pits at the sedimentary surface, well comparable in size and shape. Both structures are also similar to much larger structures found in the Great Artesian Basin of Australia.

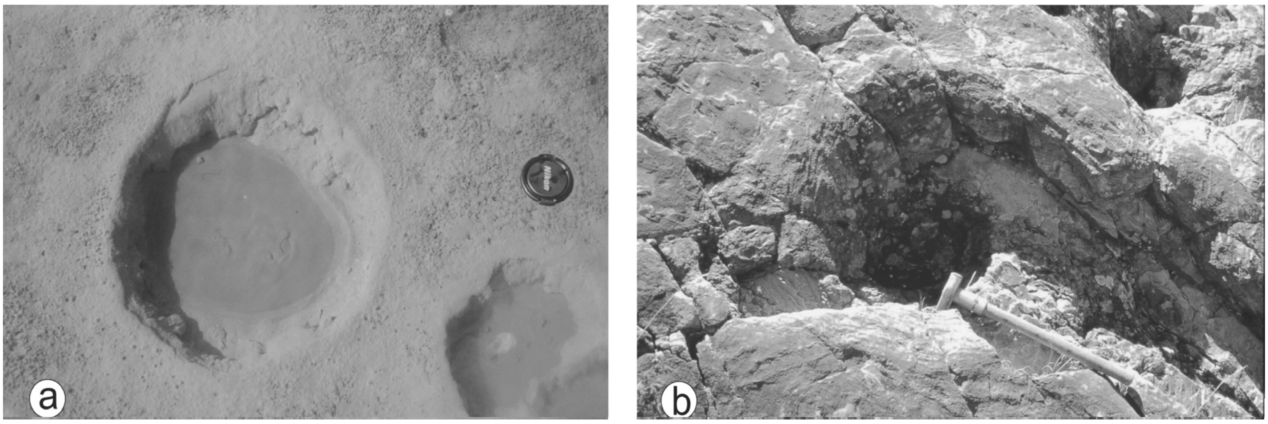

***Figure 1. a)** Active, under water spring pits in an Alpine lake Lingti Valley, NW Himalayas. **b)** Spring pits in the Lower Devonian Muth Formation, Pin Valley, NW Himalayas.*

The density structure and isostatic state of the Eastern Alps

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Recent results of the seismic profile TRANSALP initiated new investigations of the lithospheric density structure in the Eastern Alpine area. By combining seismic results with geological models, tomographic studies and other available information the 3D density structure were modeled according to the Bouguer anomaly field and geoidal undulations. Especially the upper crustal structures (< 10 km depth), which can easily connected to surface tectonics, are extremely well constrained. These structures give an amount of up to 30 % of the connected Bouguer anomaly.

Major problems in the modeling process concerned the question of defining a common crust-mantle boundary in gravity and seismic/tomographic studies. The seismic crust-mantle interface shows a depth of some 40 km in the Adriatic area, leading to a lower crustal thickness of around 10 km, while the “gravity Moho” points to a depth of around 30 km. A 40 km thick crust would require high densities in the Adriatic crust (3100 kg/m³ for the lowest structures) to fit the model to the observed gravity fields. These values are unusual for crustal domains. A probable answer to this problem is crustal underplating/doubling or a detached Moho interface. In the northern European foreland both models show a crustal thickness of around 30 km.

This density structure modeling provides information of the isostatic behavior of the Eastern Alps, which are probably not in isostatic equilibrium and show great isostatic anomalies in the sense of Airy isostasy. The shape of the isostatic residual and the good correlation between the first and the surface tectonics, points to the upper crustal structures as a reason of the not balanced isostatic state. This buried masses affect the isostatic state and have to be considered in further analysis like regional isostatic models (Vening-Meinesz isostasy).

The model of a flexed “thin elastic plate” is such a regional model, for what the significance in mountainous areas was shown in numerous studies. This model considers the calculation of the flexural rigidity D or, equivalently, the effective elastic thickness T_e. This D is connected to the topographic and crustal, internal loads and their distribution. The modeled density structures can now be used to derive this internal, subsurface loading, which is essential for a calculation of the flexural rigidity. The density model indicates that the subsurface loads of the Alpine crust are as important as the topographic loading.

The analysis of flexural rigidity was done by the convolution method, which is a new approach to calculate D and overcomes some analytical problems of previous used methods. One of the major advantages of this method is that the flexural rigidity can be calculated with a spatial resolution of around 100 km. Therefore different regions of D can be distinguished.

The T_e values are generally low within the study area. Highest values are found in the NE , while the main body of the Alpine range has values around 1-3 km. The residuals between the Moho by the 3D density model and the Moho by flexure analysis are altogether low, in the order of 2-3 km, except in the southern part, in correspondence of the Vicenza gravity high and in the area where the Moho interface reaches its deepest values (area East and Northwest of the town of Bolzano).

The low value of T_e in the central part of the Alpine range shows that here the crustal thickening conforms to that of a thin plate with low rigidity, near to an Airy-type