BUNSEN &KIRCHHOFF untersuchten in den Jahren 1859/60 mit der von Ihnen entwickelten Spektralanalyse systematisch Spektren von Alkali- und Erdalkalimetallsalzen. Die damit verbundenen Untersuchungen in BUNSENS Labor zeigten die extreme Empfindlichkeit dieser Methode. So konnte BUNSEN nach Verpuffen von Natriumchlorat mit Milchzucker und Durchmischen der Laborluft mit einem aufgespannten Regenschirm noch wenige Millionstel eines Milligramms an Natrium im Spektralapparat sehen. Dies galt nicht nur für Natrium, sondern auch für alle anderen untersuchten Alkali- und Erdalkalimetallsalze. BUNSEN zeigte dann, dass oft Elemente in Substanzen vorkommen, wo man sie bisher nicht gefunden hatte. Z. B. wurde Lithium in Graniten, Mineralwässern, in Aschen von Tabak, Blättern und Feldfrüchten und „(Zitat)…*in der Milch der Thiere, welche mit jenen Feldfrüchten genährt werden*“ nachgewiesen. Auf Grund dieser Erkenntnis schloss BUNSEN, dass es vielleicht noch andere Elemente geben könnte, die durch ihr geringes Vorkommen, mit den bisherigen chemischen Methoden noch nicht entdeckt wurden. Nach nicht allzu langer Zeit konnten die beiden Forscher im Dürkheimer Mineralwasser ein neues Alkalimetall entdecken, dass sie wegen der beiden charakteristischen himmelblauen Linien im Spektrum Cäsium nannten („*caesius*“ wurde in den Attischen Nächten von AULUS GELLIUS für himmelblau verwendet). Um dieses Element genauer zu untersuchen musste BUNSEN 44200 kg Dürkeimer Mineralwasser aufbereiten um ca. 7 g Cäsiumchlorid (CsCl) zu erhalten. Dazu dampfte er diese Menge auf 240 kg in einem Sulfatofen einer Sodafabrik ein. Aus dieser Mutterlauge wurden Calcium und Magnesium in mehreren Fällungen abgetrennt und die filtrierte Lösung weiter eingedampft. Die nachfolgenden Verarbeitungen erfolgten nun im Labor von BUNSEN. Als ersten Schritt extrahierte BUNSEN den Rückstand der Eindampfung mit Alkohol, wobei 6,5 kg Salzmasse zurückblieb, die größtenteils aus NaCl und KCl bestand. Nach Auflösen in Wasser und fraktionierter Fällung mit Platinchlorid sowie 15-20 maliges Auskochen jeder Fällungsfraktion ergaben sich Hexachloroplatinate von Cäsium und Rubidium. Um nun Chloride zu erhalten wurden die Platinate im Wasserstoffstrom reduziert und mit Wasser ausgewaschen. Bunsen erhielt dadurch ein Gemenge mit 7,27 g CsCl und 9,24 g RbCl. Die Trennung der beiden Alkalien gelang BUNSEN indem er sie mit Schwefelsäure zu Sulfaten verwandelte und mit Bariumhydroxid zu den Ätzalkalien umsetzte. Die entstandenen Hydroxide wurden anschließend teilweise mit Ammoncarbonat zu Carbonate umgesetzt und mit Alkohol abermals extrahiert. Dabei ging nur das Cäsiumhydroxid in Lösung, welches BUNSEN zur weiteren Untersuchung verwendete.

AULUS GELLIUS. Noctes Atticae II, 26, 19.

KIRCHHOFF, G. & BUNSEN, R. (1860): Chemische Analyse durch Spectralbeobachtungen. - Ann. Phys. und Chemie, **110**: 161-189.

Geochemical proxies from limnic-marine cores (Upper Cretaceous Gosau Group) underneath the Vienna Basin

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The aim of the *Gosau Inventory* project (Commission No. FA 536004, University of Vienna in cooperation with OMV AG under the scientific responsibilities of Michael Wagreich and project staff Stephanie Neuhuber, Erich Draganits, Gerald Hofer and Magda Bottig; monitored by Philipp Strauss, OMV) is to create a synopsis of the present knowledge and incorporation of new methods and new data for the Upper Cretaceous-Paleogene sediments of the Northern Calcareous Alps, their continuation into the basement of the Vienna Basin and analogues in the Slovak part of the Western Carpathians.

The Gosau Group of the Northern Calcareous Alps (NCA) consists of Upper Cretaceous to Paleogene strata unconformably overlying folded and faulted Permian to Lower Cretaceous units. It plays an important role in the exploration of hydrocarbons from Alpine reservoirs like the Hauptdolomite within the basement of the Vienna Basin. These limnic to marine successions are exposed at the south-western (Lower Austria) and the north-eastern (Slovakia) margin of the Vienna Basin and continue as NE-SW-striking synclines underneath the Neogene of the basin. These synclines (like the Gießhübl, Grünbach or Glinzendorf syncline) are located on different Alpine nappes and can act as seals in the hydrocarbon system.

Because the structural positions of the different Gosau units are not trivial and clear, core samples from various boreholes as well as samples from outcrops are geochemically investigated in cooperation with the OMV AG to characterise the paleodepositional conditions (e.g., paleosalinity), facies and provenance of the sediments and to correlate the units from the different boreholes and synclines. Major-, trace- and rare earth elements (bulk rock) as well as isotope-geochemistry (C, O, Sr) are used to define geochemical proxies which are also combined with data from heavy minerals.

In the boreholes Markgrafneusiedl T1 and Glinzendorf T1 limnic parts have lower carbon isotope values between -3 and -8 VPDB while marine intervals are characterised by relatively higher values between 0 and -3 VPDB. Boron contents rise generally from 80 to 100 ppm in the non-marine parts to values up to 142 ppm in the marine intercepts.

Differences in the provenance of the marine and limnic parts were investigated by using concentrations and ratios of trace elements. Non-marine successions of the cores show in many cases higher chromium and nickel contents up to sometimes more than 400 ppm while marine samples normally lie under 150 ppm chromium and 100 ppm nickel concentrations. In addition to that these freshwater influenced samples are in many cases enriched in Cr/V-ratio relative to the Y/Ni-ratio and therefore trend to an ultramafic source. Also in the heavy mineral spectra it can be observed that generally limnic parts are dominant in chrome spinel which corroborates the hypothesis of a Tethys ophiolitic suture to the south of the Northern Calcareous Alps as a significant source within non-marine successions.

Preliminary results from the Palaeocene/Eocene boundary sedimentary rocks of Austria: Microflora and palaeoclimate interpretation

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This paper reports on the first microflora including coccoliths, dinoflagellates, pollen and spores from P/E-boundary strata (ca. 55 ma) in Austria. The original accumulation place was situated along the north western margin of the Tethys on a shallow southern shelf of the European Plate. This newly discovered outcrop (25 km to the north of Salzburg) today is part of the South-Helvetic thrust unit. Using the palaeogeographic reconstruction of Scotese & Golonka (1992), the palaeolatitude can be estimated as approximately 40° northern latitude. The dinoflagellate assemblages are dominated by an acme of the Upper Palaeocene taxon *Apectodinium*, which makes up 62 % of the total marine palynoflora, particularely *A. augustum*, which is thought to be typical for the P/E boundary strata. The thermal maximum at the Palaeocene/Eocene-boundary lasted ca. 170000 years (Röhl et al. 2007), but previously investigated terrestrial plant communities (North America: Harrington 2003, Wing et al. 2003; Australasia: Crouch & Visscher 2003; north western Europe: Collinson et al. 2003, 2009) did not display high quantities of typical megathermal elements as known from the Eocene megathermal event. Our new findings confirm these results: The pollen and spore assemblages are dominated by various *Normapolles* taxa, gymnosperms are extremely rare. Climate-indicating palynomorph taxa occur in small numbers only (counts from one to seven), generally below 1 %. They mostly represent warmth-loving taxa from more mesothermal conditions („subtropical“), such as, *Ilex*, *Lithocarpus*, *Trigonobalanopsis*, Hamamelidaceae, Rutaceae, Juglandaceae, Rhoipteleaceae, *Parthenocissus*, Restoniaceae and Schizaeales, whereas true megathermal („tropical“) taxa are represented by few families, only, such as Arecaceae (2), Anacardiaceae (1) Sapotaceae (2), Icacinaceae (1), Bombacaceae (1), Myristiceae (1) and Sterculiaceae (1). In future, further localities will be explored and might shed more light on the question why the P/E atmospheric warming, had not caused a severe turnover in land vegetation.

Collinson, M.E., Hooker, J.J. & Gröcke, D.R. (2003): Cobham lignite bed and penecontemporaneous macrofloras of southern England: A record of vegetation and fire across the Palaeocene-Eocene Thermal Maximum. - (In: Wing, S.L, Gingerich, P.D., Schmitz, B. & Thomas, E. (Eds.): Causes and consequences of globally warm climates in the Early Paleogene), Geol. Soc. Am. Spec. Pap., **369**: 333-350.

Collinson, M.E., Steart, D.C., Harrington, G.J., Hooker, J.J., Scott, A.C., Allen, L.O., Glasspool, I.J. & Gibbons, S.J. (2009): Palynological evidence of vegetation dynamics in response to palaeoenvironmental change across the onset of the Paleocene-Eocene Thermal Maximum at Cobham, Southern England. - Grana, **48**: 38-66.

Crouch, E.M. & Visscher, H. (2003): Terrestrial vegetation record from across the Initial Eocene Maximum at the Tawanui marine section. - (In: Wing, S.L, Gingerich, P.D., Schmitz, B., & Thomas, E. (Eds.): Causes and consequences of globally warm climates in the Early Paleogene), Geol. Soc. Am. Spec. Pap., **369**: 351-364.

Harrington, G.J. (2003): Wasatchian (Early Eocene) pollen floras from the Red Hot Truck Stop, Mississippi; USA. - Palaeontology, **46**: 725-738.

Röhl, U., Westerhold, T., Bralower, T.J. & Zachos, J.C. (2007): On the duration of the Paleocene-Eocene thermal maximum (PETM). - Geochemistry Geophysics Geosystems, **8**/12, doi:10.1029/2007GC001784.

Scotese, C.P. & Golanka, J. (1992): Paleogeographic atlas, PALEOMAP progress report 20-0692. - 34 p., (University of Texas) Arlington.

Wing, S.L., Harrington, G.J., Smith, F.A., Bloch, J.I., Boyer, D. M. & Freeman, K.H. (2003): Transient floral change and rapid global warming at the Paleocene-Eocene boundary. - Science, **310**: 992-996.

Human occupation of the High Himalaya range: archaeo-botanical evidence from a high alpine meadow in NW-Bhutan

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High alpine environments place severe constraints on a full-scale human occupation due to a series of geomorphologic, ecologic and physiological parameters. As a consequence high altitude landscapes like the Tibetan Plateau (e.g., Brantingham et al. 2007), the High Himalaya (e.g., Meyer et al. 2009) or the central European Alps (e.g., Tinner et al. 2007) were only permanently colonized in the course of the Holocene i.e. by Neolithic tribes with special economic and social as well as physiologic adaptations which allowed them to survive under these rather harsh climatic conditions. Nevertheless, the available archaeological and palaeoenvironmental evidence for prehistoric human activity in high altitude environments is extremely sparse partly due to the number and intensity of erosional processes, which are capable of destroying traces of former human occupancy within a short time. Here we present archaeo-botanical and paleoenvironmental data from the high alpine valleys in NW Bhutan (4000 - 4500 m asl.) which provide one of the earliest proofs of human activity yet known for the High Himalaya range.

The archaeo-botanical data were retrieved from a high al-