little porosity (e.g. KOHN & CERLING, 2002). Excellent preservation of original isotope compositions in fossil rodent tooth enamel has been found in specimens dating back to Palaeogene times (GRIMES et al., 2003; Gehler et al.,in press). To track meteoric water values a further key requirement is that the investigated fossil small mammals had an obligate drinking behaviour and were associated to a local water body (GRIMES et al., 2003, 2008). Evidence for a high drinking water consumption, especially in arvicolids, is given by experimentally determined water flux rates (NAGY & PETERSON, 1988 and refs. therein). This is further corroborated by our new triple oxygen (^{16}O, ^{17}O, ^{18}O) isotope data for arvicolids and by comparison to these data to those of murids from the same locality.

Inter-specific oxygen isotope variations are related to differences in physiology, diet and/or drinking behaviour. The present case study clearly indicates a specific relationship between the oxygen isotope composition of local surface water and biogenic apatite on the family level and as a function body size.

Intra-specific oxygen isotope variations are mostly attributed to variations in the oxygen isotope composition of ingested drinking and food water (i.e. seasonal differences and/or isotope fractionation by evaporation). The studied samples show relatively low intra-specific oxygen isotope variations, comparable to those observed for large mammals.

Our data thus underscore the high potential of oxygen isotope compositions of enamel bioapatite from fossil small mammals as a valuable palaeoclimate archive.

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Freies Thema

Eomyids: Premature death or happy old age?

Anne Blair Gould[1,2] & Lars W. van den Hoek Ostende[2]

Teeth can tell us a lot about mammals that went long ago extinct. Usually, we focus on single specimens, whether it is to study the morphology, the micro wear or even the

isotope signature. Thus, we can learn about a species food preference, the actual food it ate or the climate it lived in. This research is based on combining data from populations, in an attempt to determine relative life strategies. By studying assemblages of different representatives of the eomyid genus *Ligerimys*, we aim to discover whether some species were more K-select than other. In other words, could some species hope to reach a happy old age, whereas others were destined for a premature death. *Ligerimys* is a genus that lived in Europe at the end of the Early and beginning of the Middle Miocene. It was chosen as a study subject, as various species of the genus lived in a period of great changes, both in the climate and in the overall faunal composition (VAN DEN MEULEN & DAAMS, 1992).

Because molars wear with age, the wear stage can be used as a proxy for the age at the time of death (FREUDENTHAL et al., 2002). Thus, a curve of different wear stages in an assemblage would ideally approximate the death curve of the population. In r-select species, we would expect such a curve to have a steep slope, indicating that many individual died young. K-select species, on the other hand, would have more individuals reaching the higher wear stages.

We measured wear by dividing the exposed dentine area by the total area of the crown (FREUDENTHAL et al., 2002). Teeth were than assigned to 10% classes (i.e. 0-10% dentine exposed = class 1, 10-20% dentine exposed = class 2, etc.). In addition, the height of the crown was measured, in order to have a second, independent measure for wear. Indeed, the curves for the various species showed a large number of relatively unworn specimens, with gradually less representatives in each following class. This is the pattern we would expect in a death curve, and we conclude that the measuring wear gives indeed a good approximation of the death curve of a population. Furthermore, assemblages of the same species yielded similar curves, whereas there were differences between species, confirming our conclusion. Other results were less expected:

1. Curves differ considerably for different elements. The M2 curve is less steep in species than the M1 curve. Presumably, this is due to the later eruption of the M2. This has consequences for the lower molars. As m1 and m2 cannot be distinguished on the basis of individual teeth, only a combined curve can be reconstructed. We have to assume that the shape of this curve is partly dependant on the relative number of m1's and m2's in the sample. Some species showed a much faster rate of wear, as shown by the height vs. wear surface curves. In particular, *Ligerimys antiquus* showed a very rapid decrease of crown height.

2. We were particularly interested in the life strategy of the last surviving member of the genus, *Ligerimys ellipticus*. As it lived in a period in which r-strategists more and more dominated the faunas (VAN DER MEULEN & DAAMS, 1992), we had beforehand assumed that it would also have resorted to a more r-select life strategy. The opposite turned out to be the case. *Ligerimys ellipticus* appears to be the most K-select species of the ones we investigated.

Apparently, it became more of a specialist, until resources ran out as aridity struck the Spanish inland.

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Freies Thema

Deciphering the influence of solar cycles in a Late Miocene lake system

Mathias Harzhauser[1], A.K. Kern[1], O. Mandic[1], W.E. Piller[2] & A. Soliman[2]

To detect short-term environmental evolution during the warm and moist Tortonian a continuous 6-m-core of the Paleo-Lake Pannon was analyzed in 1-cm-sample distance to provide information on natural gamma radiation (GR) and magnetic susceptibility (MS) combined with the total abundance of ostracod-shells. These proxies are expected to be indicative for input from the hinterland by runoff and/or rain (GR), bottom conditions and bacterial activity (MS) and bottom-water oxygenation (ostracods). All three data-sets display regular fluctuations and modulations which can be visualized in Lomb-Scargle and REDFIT periodograms and wavelet spectra. Converting these frequencies into the time-domain, based on previously published sedimentation rates for Lake Pannon in the Vienna Basin, resulted in cyclicities which agree well with known solar cycles deduced from Holocene isotope records. By adopting the hypothesis, that the observed cycles represent solar cycles, a best-fit adjustment of the sedimentation rate revealed a full fit to the proposed solar cycles. This in turn might be a method to estimate hypothetical sedimentation rates in sedimentary sections for which no age control can be established. The most striking support for the interpretation of the observed cycles is firstly the surprising similarity of the modulation of the signals with those from the Holocene and secondly the appearance of an "Earth-system-immanent-1500-yr-cycle" in Upper Miocene lake deposits.

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Zukunftspreis

Paläobiodiversität einer obertriassischen Fauna aus der Cassian-Formation (Norditalien, Dolomiten)

Imelda Hausmann[1] & Alexander Nützel[1]

Eine hochdiverse Fauna aus den mergeligen Sedimenten der Cassian-Formation (Stuores Wiesen, obere Trias, frühes Karnium) wurde hinsichtlich ihrer Diversität und Paläoökologie analysiert. Das Material ist gut erhalten, obwohl mikrobielle, karbonatische Umkrustung häufig vorkommt. Zwei unterschiedliche Proben, zum Einen eine Schlämmprobe, zum Anderen eine Oberflächenaufsammlung, wurden paläoökologisch ausgewertet.

Die Schlämmprobe bestand aus 16,5 kg Sediment, welches geschlämmt und mit einer Maschenweite von 0,5 mm gesiebt wurde. Die Fossilien aus der Schlämmprobe und der Oberflächenaufsammlung wurden ausgelesen, sortiert und bestimmt. Zusätzlich wurden die häufigsten Arten fotografiert und mit REM-Bildern dokumentiert. Die Schlämmprobe enthält ungefähr 2000 bestimmbare Exemplare, die ca. 200 Arten repräsentieren. Ferner enthalten die Rückstände zahlreiche Ooide und mikrobiell umkrustete Körner; aus der Oberflächenaufsammlung konnten nur rund 100 bestimmbare Fossilien und ungefähr 50 Arten gewonnen werden. Die meisten Fossilien sind sehr klein und messen nur wenige Millimeter in der Länge. Größenverhältnisse und Zusammensetzung der Proben unterscheiden sich eindeutig voneinander. So sind in der Oberflächenprobe keine kleinen Arten und Fossilien vorhanden. Crinoiden, Ophiuroiden und Ostrakoden konnten nur in der Schlämmprobe, nicht jedoch in der Oberflächenaufsammlung gefunden werden.

Die gewonnene Fauna ist hoch divers und durchaus mit den reichen Cassianer Rifffaunen von der Seelandalpe vergleichbar. Allerdings enthält die untersuchte Probe im Gegensatz zur Fauna der Seelandalpe fast keine Riffbildner (Korallen, Kalkschwämme). Die hohe Diversität, sowie die zahlreichen Ooide und die mikrobiellen Umkrustungen legen nahe, dass das Material aus dem Flachwasser einer Karbonatplattform stammt. Es wurde ins Becken umgelagert und ist nun in den Mergeln suspendiert.

Schlämmprobe und Oberflächenaufsammlung werden von Mollusken dominiert, wobei Gastropoden am häufigsten vorkommen. Mollusken stellen auch die Gruppe mit der höchsten Artenzahl innerhalb der Fauna dar, bedingt durch den enormen Artenreichtum der Gastropoden. Die starke Molluskendominanz ist ein moderner Aspekt der untersuchten Fauna.