to two main geodynamic events: (1) slab-pull and steepening with opening of a tear window (adakite-like calc-alkaline magmas) and (2) renewed contraction associated with deep mantle processes such as slab steepening during post-collisional times (Na and K alkalic magmas). Contemporaneous post-collisional volcanism at the eastern edge of the Pannonian Basin at 2.6-1.3 Ma was dominated by Na alkalic and ultrapotassic magmas, suggesting a close relationship with thermal asthenospheric doming and strain partitioning related to the Adriatic indentation. Similar timing, magma chamber processes and volume for K-alkalic (shoshonitic) magmas in the South Apuseni Mountains (1.6 Ma) and South Harghita area at a distance of ca. 200 km imply a regional connection with inversion tectonics.

Hierarchical mapping of landforms from Digital Elevation Models (DEMs)

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Digital Elevation Models (DEMs) are used for the extraction of land-surface parameters and objects through geomorphometric analysis. Landforms are examples of objects that can be extracted or mapped through wall-to-wall classifications and further used in any application where discrete representations of land surface might serve as variable of interest. In a somehow counter-intuitive manner, most of landform classification systems work through the classification of cells, which could be further clustered to define the borders of objects. This approach is limited in several aspects, including the scattered aspect of classification in the so-called 'salt-and-pepper effect', tying the scale of analysis by the raster resolution, difficulties in including topological relationships in classification and also in developing hierarchies of landforms.

This work aims at investigating methods of producing hierarchical mapping of landforms from DEMs. In our approach, homogeneous objects are produced first through image segmentation of DEMs and their derivatives, which are further used as building-blocks in classification/mapping of landforms. Image segmentation is coupled with multi-scale pattern analysis so that the objects are delineated at characteristic scales in a data-driven fashion. Thus, land-surface parameters as derived from DEMs are segmented into relatively homogeneous areas with eCognition Developer® at a range of scales. At each scale level, local variance (LV) is calculated as the mean value of standard deviation of segments. The values so obtained are plotted against scale levels. High values of LV and its rate of change (ROC-LV) indicate scale levels where objects are associated in patterns of land-surface parameters satisfying the condition of maximizing internal homogeneity while maximizing external heterogeneity. The whole procedure has been implemented as an algorithm called Estimation of Scale Parameters (ESP). This procedure produces homogeneous spatial entities with boundaries such that coarser scale entities have precise boundaries within which finer scales entities nest perfectly. This is a condition for developing hierarchical classifications of landform elements.

We are currently investigating two methods of developing such hierarchies:

1. Breaking down complexity through segmentation and successive partitions by nested means. The initially segmented DEM at the scale corresponding to the maximum value of LV is classified in two areas separated by the mean value of elevation. Each area is extracted as independent layer on which segmentations are performed again at the scale indicated by the maximum value of LV and then partitioned at the mean value of another land-surface parameter. This procedure is iterated to produce the third level of the hierarchy. This method is being applied at macro-scale to classify the physiographic units of Africa, as well as at micro-scale to classify landform elements in a flat Dutch landscape for archaeological purposes. Both applications have produced encouraging preliminary results.

2. Semantic modeling. Real-world features and relationships between them (both horizontal and vertical) are conceptualized based on pre-existing knowledge about morphology, morphometry, and spatial context. Characteristic scales selected as above are integrated within a hierarchy where shape attributes and topologies are formalized so that targeted landforms are extracted or classified. This method is being applied to classify glacial landforms.

Benthic environmental changes in SE Aegean Sea during the last 26 ky BP: preliminary results

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Foraminifera (single-celled protists that secrete a shell-like test) are among the most abundant organisms in the deep sea (the largest habitat on Earth), and are recognized to be highly sensitive to environmental changes due to both natural and man-induced factors in marine and transitional environments. In particular, the potential of benthic foraminifera has long been recognized for their use in marine paleoenvironmental studies.

The present study focuses on a high resolution analysis of the distribution of benthic foraminifera from one SE Aegean Sea core. The main aim is to describe the impact of the environmental changes on the marine ecosystem through the study of proxies related to the benthic environment. With this goal in mind, one site was selected to investigate spatial and temporal variability as recorded by the benthic microfauna.

Detailed analysis of the benthic foraminiferal content of the core M22-18 in NE Cretan Sea, allowed its palaeoenvironmental reconstruction. The core, 270 cm long, was drilled at 360 m water depth and 39 samples (1 cm thick) were taken. Each sample was washed, sieved at 125 μm and then dried at 60^{o}C. Quantitative analysis was carried out on aliquots separated from each sample by means of a microsplitter, in order to obtain at least 250 – 300 benthic foraminiferal specimens. The number of planktonic foraminiferal tests was also recorded during picking. Based on the faunal counts, benthic foraminiferal numbers (BFN; number of specimens per gram dry sediment) were calculated. This number gives information on the taphonomy of the original living assemblage, the oxygen level, the energy level in which the sediments were deposited and to a minor extent the productivity or organic flux. The percentage of planktonic species in the total foraminiferal association (%P) was calculated as 100*P/(P+B). Raw data were transformed into percentages over the total abundance of benthic foraminifera. Reconstruction of bottom water conditions concerning oxygen content was based on the presence of the dysoxic indicators in the assemblage. For this purpose, the percentage occurrence of the well established redox fauna front dwelling taxa (Bulimina, Uvigerina, Fursenkoina, Globobulimina spp. and Bolivina spathulata/dilatata) which is related to disturbance and/or environmental stress was calculated. Two radiocarbon ages indicate that the studied sequence covers the last 26 ky BP.

BFN remains relatively stable exhibiting low values apart from the basal part of the record where BFN shows an abrupt increase. Planktonic/benthic ratios vary between 16 and 95% of the benthic assemblage.

A decrease in BFN and an increase of low oxygen indicators (infaunal taxa) suggest a strong decrease in oxygen concentrations. Poor ventilation created dysoxic condition allowing the presence of stressed benthic microfauna.

The group of low-oxygen taxa shows high percentages from the bottom to 240 cm, but its abundance strongly decreases between 240 and 40 cm. At 30 cm this group increases again and then remains in constant percentage values in the upper part of the core. The strong decrease of BFN and the increase of the benthic foraminifera deep infauna in the lower part of the core suggests extremely low oxygen values on the sea bottom.