Terrestrial deposits : Western Istrian Anticline as an ideal natural laboratory for the study of the regional unconformities in carbonate rocks : [poster]

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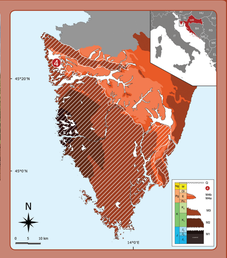
TERRESTRIAL DEPOSITS

Western Istrian Anticline as an ideal natural laboratory for the study of the regional unconformities in carbonate rocks

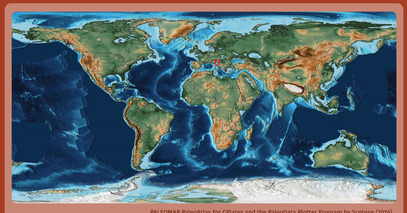
HRZZ Croatian Science Foundation
WIANLab

TERRA ROSSA



Where can we find it?

The southwestern Istrian planation surface, called “Red Istria”.



PALEOMAP PaleoAtlas for GPlates and the PaleoData Plotter Program by Scotese (2016)

When?

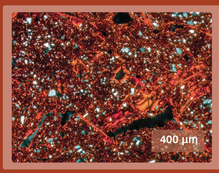
From Upper Eocene to Recent.

What happened?

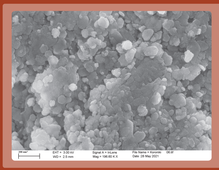
The youngest late Eocene–Recent unconformity was triggered by the collision of the Adriatic Microplate with Eurasian Plate. The duration of the stratigraphic hiatus of the late Eocene–Recent subaerial unconformity in Istria varies. In the areas where flysch was deposited in the latest Eocene, the resulting hiatus is about 35 Ma. On the limbs of the West Istrian Anticline, the hiatus was even longer due to synsedimentary tectonics, from 40 to 45 Ma, while in the apical part duration of the stratigraphic hiatus might be more than 100 Ma.

What was left?

Diferent sediments and soils/palaeosols among which terra rossa, loess-palaeosol sequences and pedo-sedimentary complexes are predominant.



Photomicrograph of the Ap/Bt1 horizon (XPL), Koreniki soil profile. Complex microstructure is moderately developed and defined by planes, channels, vughs, and chambers. Many voids are coated or filled by pure illuvial fine clay.



FE-SEM photomicrograph of soil microaggregates in the 3Btb3 horizon, Koreniki soil profile. Features indicate growth of pedogenic kaolinite nanoparticles in the soil.

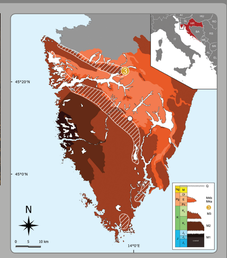
What was the environment like?

Over this long period of subaerial exposure, this area was in diferent environments, from subtropical to mediterreanean and periglacial.

What is the mineral content?

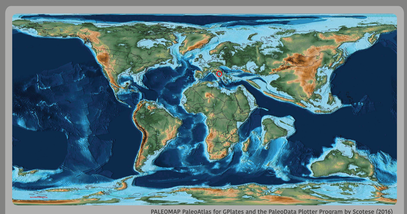
Loess and terra rossa are mainly composed of minerals which provenance is related to the submerged alluvial plain/emerged Adriatic shelf, with two diferent signatures, Alpine/Apennine and from Eocene flysch as a dominant sources. Main authigenic mineral phases in terra rosa are nanosized kaolinite and haematite.

PALEOGENE BAUXITES



Where can we find it?

Minjera mine near Sovinjak, Macinići, Bertoši, Zulijani.



PALEOMAP PaleoAtlas for GPlates and the PaleoData Plotter Program by Scotese (2016)

When?

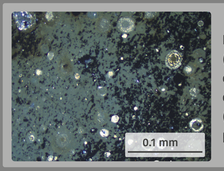
Between the early Cenomanian/ early Santonian and lower Eocene, around 65 million years ago.

What happened?

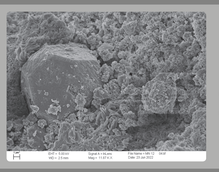
In response to the collisional tectonics, related to the collision of the Adriatic microplate and Eurasia, the Istrian part of the Adriatic carbonate platform was once again uplifted, together with the rest of the Adriatic carbonate platform. This led to the long period of subaerial exposure, marked with karstification, erosion and bauxite formation, over the course of the period of at least 25 and up to 40 million years.

What was left?

Bauxites, which formed in deep karstic depressions and canyons, together with other tropical soils and calcretes.



Photomicrograph (Minjera – D-1 deposit): The oolitic structure of bauxite and the replacement of iron oxides with iron sulphides (opaque grains in the right half of the photomicrograph).



FE-SEM photomicrograph (Minjera – D-1 deposit): Large pyrite grain (15 µm), present as euhedral cuboctahedron.

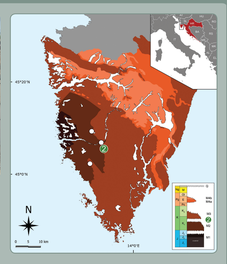
What was the environment like?

Over this long period of subaerial exposure, this area was in the tropical belt, which led to the developement of tropical soils and karstic bauxites under the vegatation cover of tropical rainforests. During the end of subaerial exposure, swamps developed atop of the bauxite bodies, which produced agressive and reducing solutions which removed iron oxides from the bauxites below, replacing them with pyrite and marcasite.

What is the mineral content?

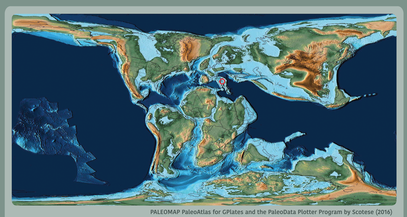
Boehmite, kaolinite, pyrite and sometimes diaspore, with minor amounts of titanium oxides, marcasite and gypsum.

CRETACEOUS PALEOSOLS



Where can we find it?

Kanfanar quarry, Lakovići quarry, Tri jezerca quarry, Istrian Y (road cut).



PALEOMAP PaleoAtlas for GPlates and the PaleoData Plotter Program by Scotese (2016)

When?

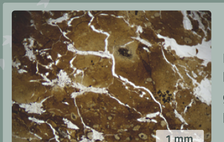
Between the Late Aptian and Early Albian, around 100 million years ago.

What happened?

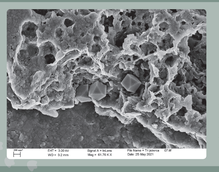
This regional emersion phase was a consequence of a relative sea-level fall caused by the interaction of eustatic changes and synsedimentary tectonics in the Istrian part of the Adriatic Carbonate Platform, resulting in variable duration of emersion (11 to 19 million years) in different parts of the platform, as well as in varying intensity of erosion of Aptian and Barremian deposits.

What was left?

Greenish-grey clays, marls, and lime breccias (several cm to 1 m in thickness).



Photomicrograph (Kanfanar): subangular blocky microstructure with visible gypsum rosettes and impregnation of peds with iron oxides.



FE-SEM photomicrograph (Tri Jezerca): Mineral particles of illite and probably mixed-layer clay minerals and idiomorphically developed pyrite with a size of 500 nm with clearly expressed hexahedral and partially octahedral forms.

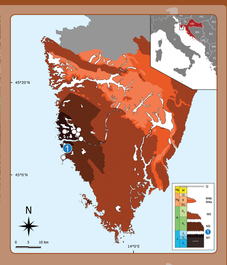
What was the environment like?

Transitional zones between the shallow-water carbonates and emergent parts of the platform were characterized by either clay and marl deposition, or extensive coastal marshes with reducing conditions and deposition of black-pebbles enriched in plant remains and pyrite formed by sulfate reducing bacteria.

What is the mineral content?

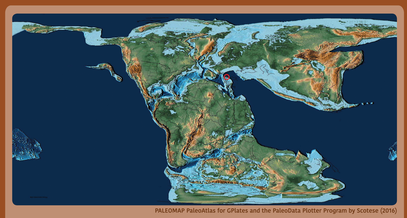
Illitic material and illite/smectite mixed layer minerals, with occasional presence of pyrite, gypsum, and chlorite.

JURASSIC BAUXITES



Where can we find it?

Rovinj-1 bauxite deposit, Zlatni rt, Vrsar.



PALEOMAP PaleoAtlas for GPlates and the PaleoData Plotter Program by Scotese (2016)

When?

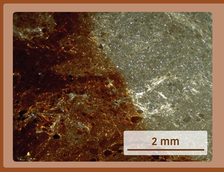
Between the early Kimmerdgian and upper Tithonian, around 150 million years ago

What happened?

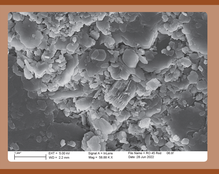
The Istrian part of the Adriatic carbonate platform was uplifted in response to the overburden pressure of the obducted oceanic crust of the Vardar ocean, which led to the karstification and erosion of the carbonate bedrock over the period of at least 6 million years.

What was left?

Large planar bauxite bodies, up to 20 m in thickness, and wetland palaeosols up to 1 m in thickness.



Photomicrograph (Rovinj-1): contact between the white and red bauxite, with visible pelitomorphic structure, bauxite clasts and clear clay coatings.



FE-SEM photomicrograph (Rovinj-1): cluster of kaolinite platelets (100-1000 µm in size), with one kaolinite grain exhibiting a typical booklet morphology.

What was the environment like?

Tropical rainforests developed over the karstified terrain as this area was well within the tropical belt during this time, which led to the formation of tropical soils and karstic bauxites below the vegetation cover. In the areas with lower palaeotopographic position wetlands developed opposed to tropical rainforests.

What is the mineral content?

Boehmite, kaolinite and haematite, with minor amounts of titanium oxides, chlorite and illite.

This work has been fully supported by the Croatian Science Foundation (project no. IP-2019-04-8054 WIANLab - „Western Istrian Anticline as an ideal natural laboratory for the study of the regional unconformities in carbonate rocks“)

Design by ANIRAM