

(Rif, Middle Atlas and north-east of the High Atlas) and Algeria. *Cedar* populations are also threatened by global warming, particularly by the projected increase of winter temperatures. Cedar and fir pinsapo forests have undergone a dramatic decline during the Late Holocene along Betic-Rif arc. To understand the factors involved in this decline, a long-term approach on climate change and anthropogenic disturbances is needed. But to date, few well-dated environmental and pollen records are available for this area to draw significant conclusions. Here, we present high-resolution pollen sequences sampled in western/eastern Rif Mountains (Fifi, Targuist, etc.), as well as Sierra de las Nieves (Ánimas) in Betic Mountains. The results of the available data explain the role of climate and human activities as drivers of the observed transformations during the last millennia. However, it is still very difficult to identify which is the main responsible for the reduction on the cedar and fir pinsapo forests along the Betic-Rif Mountains: the human impact, climate or both. This work was funded by RELICFLORA-P11-RNM-7033 (Excellence Research Projects Program from the Andalusian Government) and DESIRÈ-HAR2013-43701-P (Plan Nacional I+D+I, Spanish Ministry of Economy and Competitiveness).

Keywords: pollen records, forest decline, climate, human activities

Vegetation changes and perturbation events by anthropic activity based on core peat bogs in Escalerani (Bolivia)

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We realized a palynological study from 1 m depth sediment core. The study area is in the Paramo yungueño, nearest a *Polylepis* forest remnant, in the eastside of the Cordillera Real, Escalerani. The results show a relationship between Poaceae and Asteraceae pollen before 7505 cal. yr BP, during a phase wetter than the present. The literature shows that *Polylepis* does not disperse beyond 100 m, then we can conclude that the presence of *Polylepis* pollen around 5600 cal. yr BP, could give us insights about a major extension of the *Polylepis* forest near the peat bog. Additionally, there is another charcoal peak 3655 cal. yr BP that is coincident with a Poaceae, probably Festuca-type, the results might indicate the beginning of the camelids harvest nearby. Furthermore, there are charcoal peaks starting at 450 cal. yr BP, which indicate an increase in fire frequency until the present. These results are also supported with a reduction of pollen taxa concentration, and are coincident with the beginning of the Columbian colonization. The top of the core is characterized by high values of *Plantago* pollen, presently the most important element in the peat bog. Recent C13/15N and XRF analyses provide a better understand of Climate Change by analyzing their responses to major types of continental climate forcing.

Keywords: Escalerani, pollen, charcoal, isotopes.

Pollen records in sediments from Encantada Lake, Ilhéus, Bahia, Brazil

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The aiming this study is to investigate the sediments from Encantada Lake (14°36'28"S and 39°08'28"W), located in the Southern part of the State of Bahia. This region contains one of the most important tracts of the primary Brazilian Atlantic Rainforest, a hotspot of biodiversity characterized by high rates of rare and endemic plant and animal taxa. We collected a 600 cm long core (last 1510 +/-30 cal. yr BP), using a Livingstone sampler and 1cm³ samples at 5 cm intervals along the core, treated with hydrochloric acid,

hydrofluoric acid and potassium hydroxide. Afterwards, sediment samples were submitted to acetolysis and mounted on glycerin-coated slides for light microscopy analysis. Spores of *Lycopodium clavatum* L. were added in order to get the concentration of pollen grains at the samples. Preliminary pollen analyses revealed the presence of 157 pollen types associated to 47 families, which is in accordance to floristic studies of Atlantic Rainforest for region. Considering a minimum of five taxa by family, Asteraceae, Bromeliaceae and Meliaceae (5), Cyperaceae (7), Arecaceae and Bignoniaceae (8), Mimosaceae and Rubiaceae (9), Euphorbiaceae (10) and Fabaceae (22) are the family best represented. Pollen analysis have not yet been completed, but it is possible conclude that the diversity of pollen types registered, express the high floristic diversity that characterizes the Brazilian Atlantic Rainforest, especially in Bahia, which has no records in palaeopalynological studies. Moreover, this sedimentary basin can reveal the environmental history from Atlantic Rainforest for Bahia. Financial support: CNPq (485672/2013-8).

Keywords: Palaeopalynology, Atlantic rainforest, Pollen types, Palaeoenvironmental, Late Holocene.

Paleovegetation changes in the last 10,000 years, Rio Doce Basin, southeastern Brazil: evidences from palynology

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Paleovegetation changes in the last 10,000 years Before Present (BP) of the largest natural lacustrine system in South America, the mid-valley of Doce river, specifically within the *Parque Estadual do Rio Doce (PERD)*, inside the Atlantic rainforest, were accessed using the palynology analysis. Cores LC-02 were drilled in the north-central region of the PERD (19°39'01"W and 42°34'47 "S). Seventeen core samples of LC-02 were prepared using the standard method of palynological preparation. At least 300 grains of palynomorphs were counted for each sample. The basal age of 10,375 cal. yrs BP for LC-02 indicates that the sediments provide a Holocene history. The non-arboreal taxa Cyperaceae, Poaceae and Pteridophytes *Blechnum* were the most abundant taxa in the fossil pollen spectra in most samples (up to >46%). The palynomorphs were grouped into five vegetation groups: swamp, *Cerrado*, Atlantic forest, Pteridophytes and algae. The paleovegetation changes were evidenced from an analysis of hierarchical clustering and stratigraphically constrained, where four main zones were distinguished: Zone A (10,375—9,350 cal. yr BP); Zone B (9,350 —8,195 cal. yr BP); Zone C (8,195—4,500 cal. yr BP) and Zone D (4,500—102 cal. yr BP). The changes in floral composition were confirmed using a detrended correspondence analysis (DCA). The Zone A has low pollen concentration that is coincident with a more coarse-grained interval. The zone is dominated by herbaceous taxa (Poaceae and Cyperaceae). The woody taxa are represented by *Ilex*, *Baccharis*, *Vernonia*. The Zone A is interpreted as fluvial environment. In the Zone B persists the dominance of herbaceous taxa accompanied by lowest values of pollen concentration. In this zone is first time recorded the *Mauritia flexuosa* (at 9.350 cal. yrs BP) that is indicator of "veredas" now-a-days (palm swamps today). These vegetation communities support a swampy or water-logged forest interpretation, corroborated by the first recorded with security the presence of algae, especially of *Spirogyra*. The transition from Zone B to Zone C is coincident with abruptly decrease of Poaceae pollen and increase of Cyperaceae. The lacustrine system already installed and high abundance and diversity of Pteridophytes are recorded. The last 4500 years (Zone D) occurs the highest pollen concentration (at ~2705 cal.). The herbaceous flora recorded the lowest abundance and is replaced by other vegetation groups (e.g. swamp, *Cerrado*, Atlantic forest). The topmost sample (102 cal yr BP) represents the environment today, i.e. a seasonally water-logged situation and therefore reflects the colmatation of the lacustrine system.

Keywords: Paleovegetation, pollen analysis, Holocene, South America, *Parque Estadual do Rio Doce (PERD)*.