

1. Research activity

The main goal of my project is a review of the palaeogeography of the Periadriatic area during the Cretaceous, based on the palaeobiogeographic constraints provided by the occurrence of several dinosaur tracksites in Periadriatic region.

The specific objectives are: i) the identification of most suitable trackmakers of dinosaur tracks from the Upper Jurassic-Cretaceous deposits of Apulia, Latium-Abruzzi and Friuli-Istria and their palaeobiogeographic distribution; ii) the identification of subaerial exposure evidences within Cretaceous deposits of the Periadriatic sector; iii) the correlation between geological and palaeontological data (including palaeobotany), to recognize the possible migration routes between Periadriatic carbonate platforms and the two mainlands Eurasia and Africa.

The Periadriatic sector (“Adria”) has been differently interpreted as: i) an independent microplate, with the Ionian Tethys connected to the Alpine Tethys to separate Adria from Africa; ii) a distal promontory of the African Plate, separating two independent oceanic domains, the Alpine Tethys and the Ionian Tethys. This debate is linked to the uncertain nature and age of the Ionian crust.

Within this framework, several domains characterized by shallow-water deposits were identified (Periadriatic carbonate platforms, [sensu 1]): i) the Adriatic–Dinaric carbonate platform; ii) the Apenninic carbonate platform; iii) the Apulian carbonate platform; iv) the Panormide carbonate platform. They were traditionally interpreted as isolated areas, separated by pelagic basins and far from the continental margins of Eurasia and Africa.

This interpretation was challenged following the discovery of several dinosaur tracks within Cretaceous deposits from Istria, Latium and Apulia. Their occurrence in Southern Italy has been reported since 1999, when the Altamura tracksite (Apulia, late Coniacian-early Santonian) was discovered. Later, many other ichnosites were identified [2, 3]. In Apulia, the trampled horizons (?late Tithonian-early Santonian) come from the Gargano Promontory and the Murge area. In Latium-Abruzzi, four tracksites (Aptian-Cenomanian) are known to date. A dozen tracksites were discovered between Friuli

and Istria (late Tithonian-Coniacian). The tracks have been referred to theropods, sauropods, ornithopods and thyreophorans.

Body fossils of dinosaurs from the Cretaceous of the Periadriatic area are known but still rare in Italy [4, 5]. Archosauriformes skeletal remains and land plant-rich horizons are also known from the same region [6]. All these data suggest the presence, throughout the Cretaceous, of emerged sectors that intermittently could have facilitated dispersal.

The diversified terrestrial ecosystem within the Periadriatic carbonate platforms in the Cretaceous suggested to some authors [7] a preliminary palaeogeographic review. Reinterpretations of known dinosaur tracks and new ones stress the need of a review of these data, also using the constraints that palaeontological data can impose on geodynamic and palaeogeographic models.

An ichnological review, focused on the research of the dinosaur trackmakers, can become more significant and reliable, if supported by new methodologies (see below). The identification of a suitable trackmaker and the related palaeobiogeographic distribution may provide new insights on the possible migration routes and improve the knowledge of the palaeogeographic relationships among the different sectors of the study area.

The project will start with a critical analysis of the data available from the literature and will include field work, laboratory and collection analysis.

The field work will include ichnological and geological surveys of the Periadriatic tracksites from:

- Apulia
- Latium-Abruzzi
- Istria
- Friuli-Venezia Giulia

The tracks will be analysed using both traditional and new methods, such as close-range photogrammetry. By means of this new method, the morphological information on tracks can be more accurate identification of the trackmakers can reach a more precise rank at the taxonomic level. As a result, the palaeobiogeographic constraints can be more reliable.

In addition to the previous field activities, a learning period will be spent in La Rioja (Spain), cooperating with the Universidad de La Rioja in the Cretaceous tracksites. Here, dinosaur body fossils are also known: the study of this exceptional fossil record (both skeletal and ichnological) is essential to enhance the correlation approaches between tracks and trackmakers.

Furthermore, will be performed a review of ichnological and skeletal specimens stored in:

- Museo Civico di Scienze Naturali di Faenza (Italy)
- Museo Civico di Storia Naturale di Trieste (Italy)

In the first two years, in order to identify the most suitable trackmakers and their palaeobiogeographic distribution, the laboratory work will involve:

- The development of a database including: i) measurements of morphometrical parameters of detected tracks; ii) skeletal and ichnological occurrences of dinosaur during the study interval; iii) terrestrial vertebrates and plants occurrences in the Adria domain.
- Statistical analyses of ichnological data.
- 3D modelling of best-preserved detected tracks by means of close-range photogrammetry.
- Analysis of the global ichnological fossil record of the study interval, comparing it with the detected tracks.
- Research of the most suitable trackmakers, by means of: i) synapomorphy-based method; ii) phenetic correlation; iii) coincidence correlation.
- Cluster analyses to match tracks from different areas, in order to correlate them to trackmakers.
- Palaeogeographic distribution of the possible trackmakers, in order to reconstruct their dispersal ways.
- Thin-section analyses of rocks from the trampled surfaces, to determine the age and the depositional environment.

In the 3rd year, with the purpose of correlating geological and palaeontological data, taking into account the emerged lands on the Periadriatic carbonate platforms and the mainlands Eurasia and Africa, the work will include:

- Literature analysis of: i) geophysical data of the Western Tethys during the Late Jurassic-Cretaceous interval, in order to obtain geodynamic constraints; ii) stratigraphical data of the Periadriatic region, in order to find evidences of emersion;
- Literature analysis of: i) global and local sea-level changes, to correlate their possible congruence with the inferred emersion episodes; ii) palaeobotanical data, to match the palaeoenvironmental affinities between the terrestrial ecosystems of the Periadriatic area.

References

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- [2] CITTON P. et al. (2015) - Palaeogeogr., Palaeoclimatol., Palaeoecol., 439, 117-125.
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- [7] ZARCONE G. et al. (2010) - *Earth-Sci. Rev.*, 103(3-4), 154-162.

2. Research products

a) Abstracts

- ANTONELLI M., SACCO E., BERNARDI M., CONTI J., TOMASONI R., PIGNATTI J. & PETTI F.M. (2019) - *Tridactyl tracks from the Lavini di Marco dinosaur ichnosite (Hettangian, Southern Alps, NE Italy): ichnotaxonomical review and palaeobiogeography*. Sessione di apertura Paleodays 2019, Benevento-Pietraroja (Italia), maggio 2019. Presentazione orale.
- SACCO E., ANTONELLI M., BERNARDI M., CONTI J., TOMASONI R., PIGNATTI J. & PETTI F.M. (2019) - *The use of aerial- and close-range photogrammetry for the mapping of the Lavini di Marco tracksite (Hettangian, Southern Alps, NE Italy)*. Seconda sessione Paleodays 2019, Benevento-Pietraroja (Italia), maggio 2019. Presentazione orale.
- PETTI F. M., PETRUZZELLI M., CONTI J., SPALLUTO L., WAGENSOMMER A., BERNARDI M., TOMASONI R., ANTONELLI M., SACCO E., PIGNATTI J., SABATO L. & TROPEANO M. (2018) - *The use of aerial and close-range photogrammetry to study dinosaur tracksites both at the meso- and macro-scale: the cases of the Lavini di Marco (Lower Jurassic, Hettangian - Trentino-Alto Adige) and Molfetta (Lower Cretaceous, Aptian-Albian - Apulia) tracksites*. Session S37 Congresso SGI-SIMP: "Geosciences for the environment, natural hazard and cultural heritage", Catania (Italia), settembre 2018. Presentazione orale.