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Inventario Español de Lugares de Interés Geológico

# CRETACEOUS - PALEOGENE STRATIGRAPHIC SECTION OF ZUMAIA SPAIN



UNESCO Global Geopark

*Eocene turbiditic system in Zumaia, which was the cover of the classic book "Atlas and Glossary of Primary Sedimentary Structures" (F.J. Pettijohn and P.E. Potter, Springer -Verlag 1964). (Photo: M. A. Langa).*

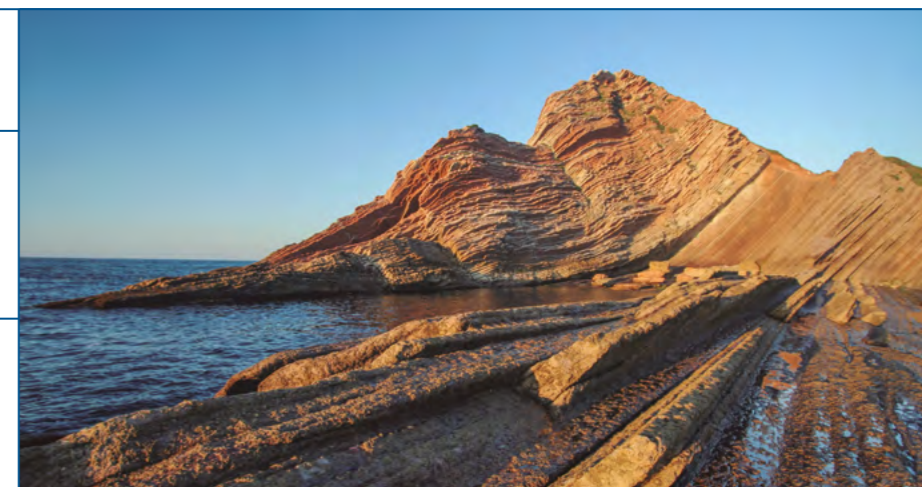
**ONE OF THE BEST EXPOSED, MOST CONTINUOUS AND HIGHLY STUDIED OUTCROPS OF DEEP MARINE SEDIMENTS IN THE WORLD.**

Zumaia section provides critical information about climate and biosphere evolution through critical intervals of geological time. The integrated bio-, magneto- and cyclostratigraphic records helped to reconstruct the K/Pg mass extinction (Gilbert V. *et al.*, 2021) and the impact of the PETM global warming in the oceans and the subsequent recovery, and to define

the GSSPs for the bases of the Selandian and Thanetian stages. The concentration of these major events marking key chronostratigraphic boundaries in a continuous section makes Zumaia one of the most studied and referenced stratigraphic outcrops of the World. Zumaia is also a key location for study of deep marine trace fossils.

## SITE 022

<b>GEOLOGICAL PERIOD</b>	Cretaceous- Paleogene
<b>LOCATION</b>	Zumaia, Basque Coast Geopark, Spain. 43° 17' 59" N 002° 15' 41" W
<b>MAIN GEOLOGICAL INTEREST</b>	Stratigraphy and sedimentology Paleontology



*Maastrichtian deep marine hemi pelagic sediments and K/Pg boundary in Zumaia.*

### Geological Description

The Cretaceous - Paleogene stratigraphic section of Zumaia is magnificently and continuously exposed along 10 km of beautiful sea cliffs on the Basque coast. This deep marine succession, brought to the surface during the Pyrenean orogeny, comprises hemipelagic marl/limestone alternations and intercalated turbidites. One of the early models of deep-water submarine fans were partly based on Eocene deposits from Zumaia (Kruit C. *et al.*, 1972). The two major events bracketing the Paleocene Epoch, i.e. the mass extinction at the Cretaceous/Paleogene (K/Pg) boundary and the global warming across the Paleocene Eocene Thermal Maximum (PETM) had dramatic environmental and evolutionary consequences and

are exceptionally well recorded at Zumaia (Ward PD, *et al.*, 1991) Extensive analyses of greatly preserved foraminifera and calcareous nannofossils have helped to refine the biostratigraphic scales and to infer the paleoenvironmental consequences of these global events (Alegret *et al.*, 2009). Additionally, detailed magneto and cyclostratigraphic studies made Zumaia a key reference section for the Maastrichtian and Paleocene astrochronological timescale (Dinnars-Turell J. *et al.*, 2014). Not surprisingly, Zumaia was unanimously selected to place the GSSPs for the bases of the Selandian and Thanetian stages, turning into one of the very few outcrops containing two IUGS Global stratotypes in the World (Schmitz *et al.*, 1972).

### Scientific research and tradition

Zumaia has long attracted Geologists' interest. Since 1946 more than 120 research articles appeared in refereed journals and more than 10 PhD Theses are partly, or entirely, based on the section. Photos of Zumaia have been used as the front cover of many publications, including Pettijohn and Potter's, 1964, Atlas of Sedimentary Structures.

*Location of the main chronostratigraphic boundaries of Zumaia section. The total stratigraphic thickness of the section is more than 5000 m, and the section, extending from the Albian to the Ypresian, is exposed continuously along 10 kilometers of sea cliffs.*

