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40.000 years of Aeolian Accretion in the Coast of NW Spain: Evolution of Coastal Dunes from MIS3-MIS2 transition to Late Holocene and Present-day Management.

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The coast of Galicia (NW Spain), about 1,700 km long, is formed by cliffs and deep estuaries (Rias) flooded during the Late Holocene and the most characteristic sediments are sand and gravel deposits. Sandy sediments (aeolianites) are the most widespread along the entire coast and they are due to a massive aeolian accumulation that began at the end of MIS3 with an initial sea-level from -60 m (below the present one) to -120 m at the end of MIS2. This involved a coastline displaced up to 40 km from its present position and the subaerial exposure of a continental shelf covered with sand, which was mobilised by the strong coastal winds as dunes. In turn, these dunes advanced towards the continental edge, filling in the valleys and covering reliefs of more than 250 m high at the time. For instance, the current Cies Islands were linked to each other and to the mainland, as the current Ría de Vigo was a densely vegetated fluvial valley. Dunes of 40 to 17 ky are observed on these islands, as well as a 35 m thick flooded dune similar to the 13 to 6 ky old flooded dunes identified in the nearby Ría de Arousa. All these aeolian formations are in physical continuity with the (relict) dunes that only remain in this coast, most of them powered by wind up to 2.5 ky ago. The sea-level rise during the Early and Middle Holocene enhanced the mobilization of sand, as also occurred on the Atlantic coast of Portugal, France and the United Kingdom. This caused both the collapse of the coastal ecosystems (forests and freshwater lagoons) that were buried under the dunes and the accumulation of sand against the rocky cliffs, as demonstrated by the climbing dunes that rise to more than +160 m (apsl); under this blanket of sand, archaeological remains and fossils of vertebrates more than 6,000 years old have been found. This aeolian transgression stopped at the Late Holocene, when rising sea-level sealed the sands' source area by marine flooding. From this point onwards, the coastal wind became mainly erosive and gradually destroyed the dunes. This was coupled with the erosive effects of waves, leading to the current situation in which it is extremely difficult to preserve the remains of the coastal dunes that have endured the Holocene transgression. To prevent this degradation of the coast, none of the measures adopted so far have been effective, from physical barriers (including the replanting of trees) or the continuous deposits of sand that are systematically destroyed during storms. Dating

of other fossil dunes in the study area using optically stimulated luminescence (OSL) or infrared luminescence (IRSL) indicates that it is still possible to distinguish older aeolian accretion events that took place during the pre-Eemian regressive episode (MIS6). Therefore, the formation of coastal dunes in northwest Spain is strongly related to glacioeustatic fluctuations, corresponding specifically to the Upper Pleistocene.