

PALEOSOILS AND COAL IN THE DISTAL  
PART OF THE SPANISH BUNTSANDSTEIN  
(MENORCA AND MALLORCA, BALEARIC ISLANDS)

by TOM FREEMAN<sup>1</sup> and ANTONIO OBRADOR<sup>2</sup>

The origin of the Spanish Buntsandstein continues to be debated; i. e., is it marine, non-marine, or "transitional"? For this reason, the character of distal deposits in the Balearic Islands is an especially important clue to the origin of the Buntsandstein in peninsular Spain.

Cross-bed measurements demonstrate a persistent southeast transport direction for the Buntsandstein over an area including peninsular Spain and the Balearic Islands of Menorca and Mallorca (FREEMAN, in preparation). That is, the Balearic Islands display the most distal exposures of what appears to be a single fluvial system. The character of these distal deposits serves to corroborate an interpretation of a fluvial origin.

Along the northwest coast of Menorca, at Cap Gros (fig. 1) the Buntsandstein contains rubbly intervals interpreted as paleosoils. Occurring along with these paleosoils are fragments of fossil wood and coal. A more impressive occurrence of coal occurs along the northwest coast of Mallorca near Banyalbufar (fig. 2). In addition to paleosoils like those at Cap Gros (fig. 3) lenses of coal occur in cross-bedded sandstones of the Buntsandstein (fig. 4). It is interesting to note that the coal does not occur in overbank mudstone deposits; instead it is restricted to channel sandstones, where it was presumably rafted as clumps of vegetation. (The absence of coal in Buntsandstein overbank deposits can be explained by the high degree of oxidation reflected by the red color of those deposits.)

---

<sup>1</sup> Department of Geology, COLUMBIA (Mo) U.S.A.

<sup>2</sup> Dpto. ESTRATIGRAFIA U.A.B. BARCELONA.

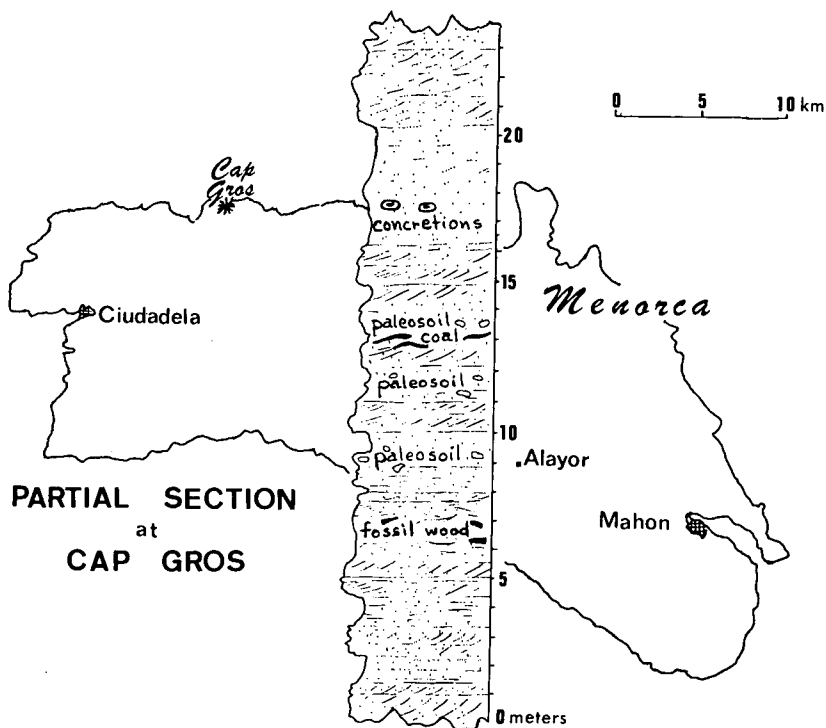


Fig. 1.—Partial section measured at Cap Gros, showing occurrence of paleosoils, coal, and fossil wood.

The coal lenses near Banyalbufar are sufficiently abundant to have prompted the digging of an exploratory shaft some five meters into the side of a sea-cliff. Along the roof of this small shaft coalified logs occur with a preferred orientation (fig. 5 A, B). The azimuth of orientation is within  $35^\circ$  of the mean cross-bed vector at this locality, suggesting that the logs were oriented by the same current system that deposited the channel sandstones.

Inasmuch as the Balearic Islands display the most distal parts of the Spanish Buntsandstein, the paleosoils and coals of Menorca and Mallorca suggest that peninsular Spain was at least equally subaerial during deposition of the Buntsandstein. It is true that there are variations in thickness of the Spanish

Buntsandstein, but the persistent transport direction shows that these differences do not reflect marine bathymetric irregularities. Instead, they reflect on a pre-Buntsandstein subaerial surface that was produced by faulting and erosion. Evidently, this local relief had little effect on the direction of Buntsandstein stream courses.

ACKNOWLEDGMENTS

This work was supported by grant GA 37112 from the National Science Foundation (U.S.A.) to TOM FREEMAN.

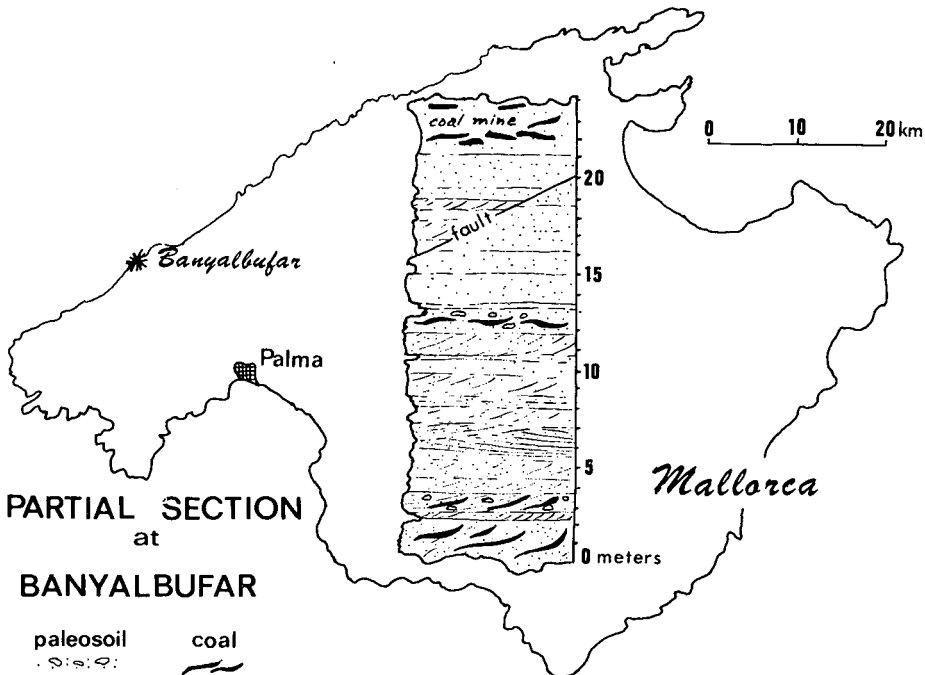


Fig. 2.—Partial section measured at Banyalbufar, showing occurrence of paleosoils and coals. Notice position of “copper mine” (exploratory shaft).

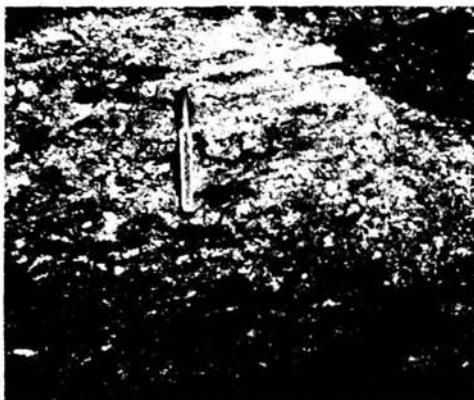


Fig. 3 -- Field photograph of paleosoil like those at Cap Gros and Banyalbufar.



Fig. 4 -- Field photograph showing lens of coal within cross-bedded channel sandstone.

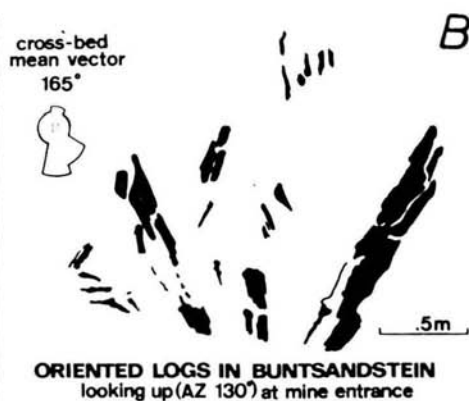


Fig. 5 -- (A) Looking up along azimuth  $130^{\circ}$  at roof of exploratory mine. (B) Sketch of photograph shown in A, along with cross-bed data.