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A re-evaluation of the basal age in the DSDP hole at Site 534, Central Atlantic

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ABSTRACT

For 30 years, the initial sedimentation following the opening of the western Central Atlantic has been considered to be of Middle Callovian age (approximately 164.5 Ma) based on the biochronostratigraphical estimation for the basal sedimentary unit of the borehole from Site 534A of the Deep Sea Drilling Program (DSDP). That age has been used in kinematic models of the opening of the Central Atlantic. A reconsideration of the available biochronostratigraphical data and correlation of the δ^{13}Ccarb record from Site 534A with those from the Tethyan and North Atlantic records suggest that the initial sedimentation at Site 534A is, in fact, of Middle Oxfordian age (approximately 160.6 Ma). The high biostratigraphic similarity among the basal sedimentary units of the boreholes at DSDP Site 534A and Ocean Drilling Program Site 801C in the Western Pacific suggest the same age for both sites. The Middle Oxfordian δ^{13}Ccarb records from the different sites covary, marking the same palaeoenvironmental changes, although such an agreement was not previously acknowledged. A combination with additional data proposes that Middle Oxfordian age corresponds to the precise date of the opening of the Hispanic Corridor between the Atlantic and Pacific oceans.

1. Introduction

The DSDP carried out from 1968 to 1983 offers much to our knowledge of the environmental changes and conditions during the geological ages. Along with other programs, the DSDP included drilling at different sites in the western Central Atlantic, such as Site 534 in the Blake-Bahama Basin [51]. The results from Site 534 access some of the oldest oceanic sediments known from the Atlantic Ocean. The sediments are overlain, breakup-related, seafloor basalts, which were spread at the opening of the Central Atlantic during the breakup of Pangaea [52]. Given the absence of direct radiometric dating, the age of the basalts is regarded as Middle Callovian on the basis of biochronostratigraphical evidence extracted from the basal layers of the borehole [17].

Various geotectonical studies have calibrated models based on the age of the basalts at Site 534A, proposing temporal scenarios for the opening of the Central Atlantic by dating the Blake Spur magnetic anomaly through extrapolation (e.g. [24,26,49]). The radiolarian configuration in the basal sedimentary unit of Site 534A is identical [4,5] to that in the basal sedimentary unit (overlying the upper alkali basalts) of Ocean Drilling Program Site 801C in the Western Pacific (Fig. 1), the location of the oldest ocean crust sampled to date [30]. The core sediments from Site 534A have also been used to extract one of the most cited δ^{13}Ccarb records of the Late Jurassic [23].

Site 534A is located in the eastern gate of the Hispanic Corridor [53], the primitive seaway that is believed to have connected the Pacific and Atlantic oceans and to have separated North and South America since the Jurassic. Therefore, the Middle Callovian is considered the oldest possible sedimentologically confirmed age for the opening of the Hispanic Corridor. It is important to confirm the basal age of the unnamed sequence that overlays the basalts at Site 534A, given the great importance of that site to the geotectonic community.

2. Materials and methods

The reconsideration of the basal age at Site 534A included the appraisal of two lines of evidence: 1) the originally inferred biochronostratigraphical data and 2) the correlation of the geochemical graph of the site with other, better-dated graphs from the current literature.

Regarding the first line of evidence, in the original publication of the results from Site 534A, the available biochronostratigraphical markers (mainly dinoflagellate cysts) were interpreted to indicate a Middle Callovian age for the basal (still unnamed) sedimentary unit [17]. In a more recent analysis, the radiolarian synthesis from Site 534A was correlated with that extracted from the sedimentation unit on the upper alkali basalts of Site 801C in the

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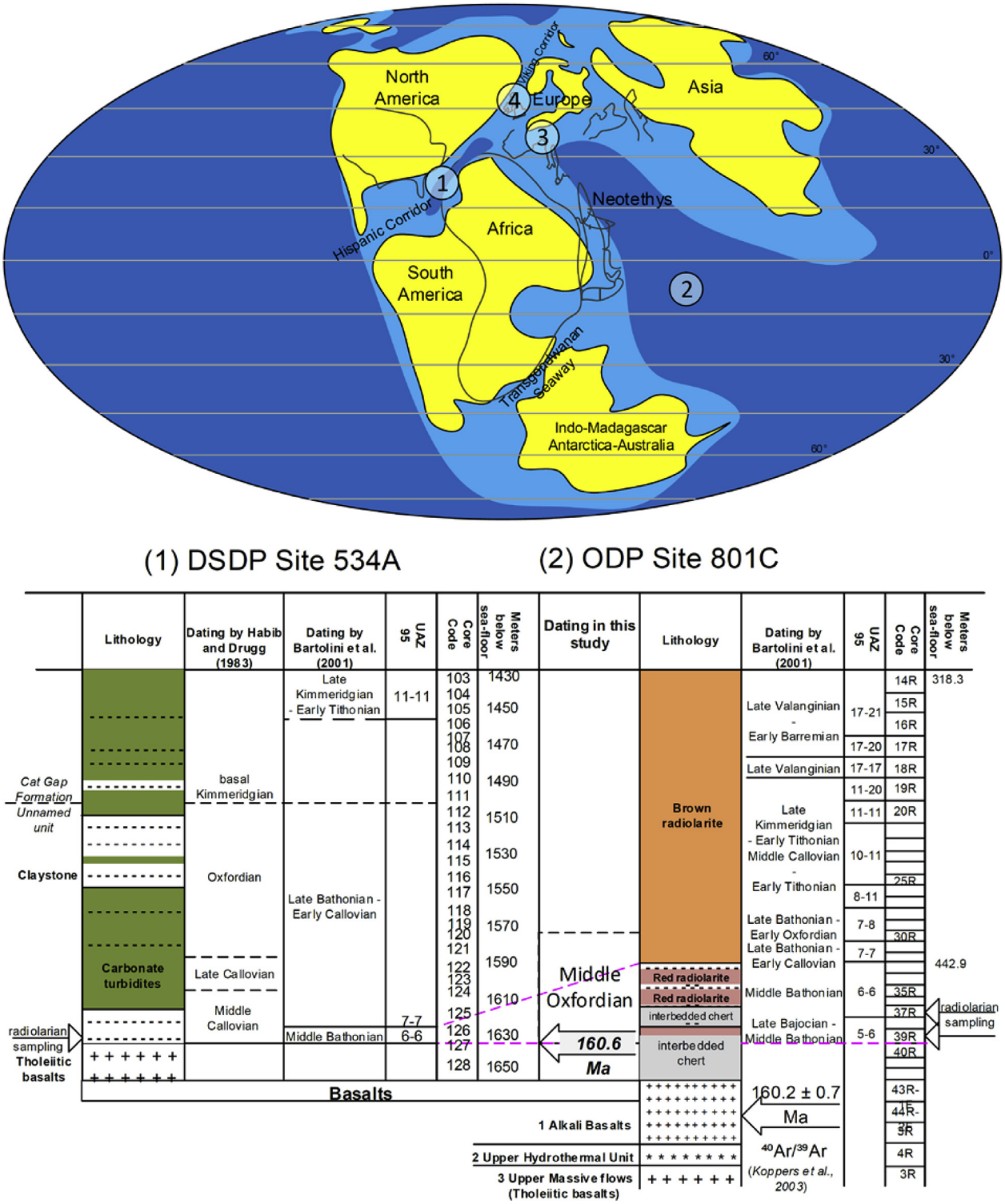

Fig. 1. Biochronostratigraphy and locations of the boreholes at sites 534A (1) and 801C (2), as well as the locations of the Trescléoux locality in southeastern France (3) and the Oze locality on the Isle of Sky, Scotland (4), on a palaeogeographic map of the Late Oxfordian. Map modified from Scotese [50]. Biochronostratigraphic chart modified from [4].

Western Pacific Ocean [5]. The concluded radiolarian synthesis was attributed to the UAZ6 (Unitary Association Zone) of the radiolarian biochronostratigraphic chart in 1995 [6], which corresponded to a mid-Bathonian age. In the original publication of the results from Site 801C, a latest Bathonian–earliest Callovian age was attributed to the basal sedimentary strata at Site 801C [32]. More recently, contemporaneous basal sedimentation of the stratigraphical successions at the two sites was claimed, with a slightly earlier age (UAZ5–6, Late Bajocian to Middle Bathonian) for Site 801C [4]. According to the latter analysis, the basal sedimentation at Site 534A is of a mid-Bathonian age (Fig. 1). In the current study, updated radiolarian biochronostratigraphical data from the current literature were searched in reconsideration of the older biochronostratigraphical estimations.