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Early Cretaceous palynostratigraphy, palynofacies and palaeoenvironments of well sections in northeastern Tierra del Fuego, Argentina

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Abstract

Palynostratigraphic and palynofacies analyses of the Springhill and Pampa Rincón formations in Argentina and the Estratos con *Favrella* in Chile, studied in 30 core samples from nine wells in northeast Tierra del Fuego, yielded an Upper Valanginian–Cenomanian(?) palynoflora. The occurrence of 71 terrestrial species (spores and pollen grains) and 39 species of organic-walled phytoplankton are considered in this paper. A correlation was made with the Upper Valanginian–Lower Aptian *Cyclusphaera psilata-Classopollis* Zone (Neuquén Basin) and the *Interulobites-Foraminisporis* Assemblage Zone in the Austral Basin (Upper Valanginian–Upper Hauterivian) owing to the presence of bryophytic species such as *Interulobites* spp. and *Polycingulatisporites* spp. and the incoming of *Cyclusphaera psilata*. *Celyphus rallus* and *Balmeiopsis limbatus* are also common in this zone. The Barremian *tectifera-corrugatus* Interval Zone (Austral Basin) was not recognized in the samples studied. The *Antulsporites-Clavatipollenites* Assemblage Zone of the Austral Basin (Aptian), which is characterized by the occurrence of early angiosperm pollen grains (*Clavatipollenites hughesii*, *Asteropollis asteroides*) and *Cyclusphaera crassa*, among others, was recorded. Near the Aptian/Albian boundary, the succession of angiosperms is characterized by the appearance of rare tricolpates. *Heterosphaeridium heteracanthun* and *Isabelidinium* sp. were identified in the *Heterosphaeridium* Superzone (Australia), indicating an age not older than Cenomanian. This corresponds to the nearshore–shallow marine facies of the Nueva Argentina Formation. Six types of palynofacies (1–6) were distinguished and, together with the composition of the palynomorph assemblages, were linked to depositional conditions, deltaic, shallow marine, nearshore and offshore environments being recognised.

Keywords: South America; Argentina; Tierra del Fuego; Magallanes/Austral Basin; Springhill Formation; Cretaceous; Palynology; Palaeoenvironment; Tectonics

1. Introduction

The subsurface Cretaceous of the Magallanes/Austral Basin has been a major target for oil and gas exploration since 1980 and palynology, together with geophysical and invertebrate data, has been used for the subdivision of fine-grained sediments.

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A comparatively large amount of published literature deals with the Cretaceous palynology of different basins in Argentina. A zonation based on a review of previously published palynological data has been proposed recently (Quattrocchio et al., 2003), and is calibrated by ammonite occurrences.

The aim of this paper is to describe the palynostratigraphic and palynofacies characteristics of the Springhill and Pampa Rincón formation in Argentina (=Estratos con *Favrella* in Chile), observed in well sections located in the northeast of Tierra del Fuego, Argentina (Fig. 1). The material was provided by the ENAP Oil Company of Chile.

As the Neuquén Basin has yielded a calibrated zonation, our results are compared with this and also with the palynological zonation of the Austral Basin (Archangelsky et al., 1984). Palynological information from Australia (Helby et al., 1987) is also considered and the zonation of Cornú (1986) for the Springhill Formation in the east of Tierra del Fuego is evaluated.

The principal palynomorph contents are noted and a palaeoenvironmental evaluation of the geological interval considered is presented. Palynostratigraphic (stratigraphic markers) and palynofacies analysis together with basin-wide log correlation are used to infer the evolution of the depositional environments. The type and state of preservation of the palynological organic matter is also considered. Determination and prediction of hydrocarbon source rock potential is evaluated especially via their thermal alteration index (TAI; Pearson, 1990). A full list of the palynomorph taxa recorded is given in Table 1.

2. Geological background

The Magallanes Basin (Austral Basin) extends along the convergent limit between the South American Plate and the oceanic portion of the Antarctic Plate in the extreme south of South America. The basin is located to the south of the triple junction, where the Nazca, South American and Antarctic plates meet. Its general orientation is north-northwest–south-southeast, and it covers an area of more than 160,000 km^2, reaching approximately 700 km in length and 370 km in width at its maximum extent (Biddle et al., 1986).

The basin is triangular in outline; in its axial part it contains up to 8000 m of sedimentary rocks, which become progressively thinner towards the east, with thicknesses varying between 1000 and 2000 m in the area of the platform (Fig. 1). Towards the north and east its boundary is with

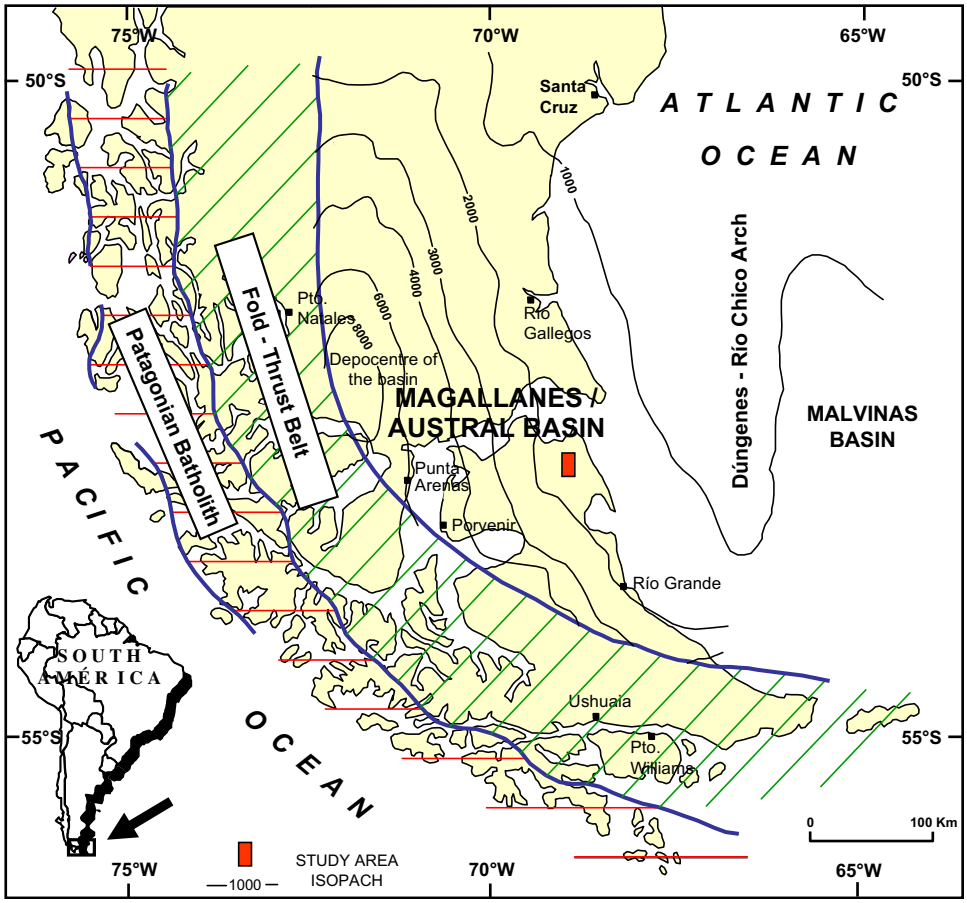

Fig. 1. Location map of the Magallanes/Austral Basin.