Biostratigraphy of Late Cretaceous planktonic foraminifera in the Southern Hemisphere : Paleogeographic and paleoclimatic implications

氏名・(本籍)	メイベリン アガディエル ゼペダ MAYBELLYN AGADIER ZEPEDA
学位の種類	博　士(理　学)
学位記番号	理博第1716号
学位授与年月日	平成11年3月25日
学位授与の要件	学位規則第4条第1項該当
研究科, 専攻	東北大学大学院理学研究科(博士課程)地学専攻
学位論文題目	Biostratigraphy of Late Cretaceous planktonic foraminifera in the Southern Hemisphere : Paleogeographic and paleoclimatic implications (南半球後期白亜紀の浮遊性有孔虫化石層序:特に古生物地理学的と古海洋学的意義)
論文審査委員	(主査)　教授 斎藤常正 教授 海保邦夫, 箕浦幸治

論　文　目　次

論 文 内 容 要 旨

Adetailed biostratigraphic and statistical analysis of faunal assemblages of Deep Sea Drilling Project (DSDP) and Ocean Drilling Program (ODP) sites from low, middle, and high latitude during the Late Cretaceous (late Santonian to Maastrichtian) in the Southern Hemisphere exhibits great variations in the temporal and geographic patterns of the planktonic foraminiferal group. Generally, except for the high latitude area, all of the sites studied are characterized by high abundance and faunal diversity during the late Santonian to early Campanian and late Maastrichtian, whereas severe fluctuations are recorded during the late Campanian to middle Maastrichtian.

The recognition of biogeographic index species allowed the segregation of biogeographic realms namely: Tethyan, Transitional and Austral. In this study, Tethyan and Transitional realms are already established during late Santonian to Maastrichtian, whereas the Austral realm developed during the late Campanian to Maastrichtian. The absence of an Austral realm during the late Santonian to early Campanian showed that planktonic foraminiferal distribution patterns during this time interval appeared to be less complex in character than in the late Campanian to Maastrichtian. These generalizations along with results from other parameters obtained from this study such as faunal composition, equitability, species dissolution susceptibility, and ratios of climatic index species were used to deduce paleogeographic and paleoclimatic conditions as well as the construction of paleoclimatic curves. These paleoclimatic curves showed particularly striking and similar trends for most of the sites under study.

Three paleoclimatic intervals namely, Interval 1(late Santonian to early Campanian), Interval 2 (late Campanian to middle Maastrichtian), and Interval 3 (late Maastrichtian) can be identified in the paleoclimatic curves: Interval 1 (late Santonian to early Campanian) suggests a relatively warm paleoclimate as evidenced by an abundance of Tethyan and warm indices, high species diversity and equitability and high positive values in the paleoclimatic curves; Interval 2 (late Campanian to middle Maastrichtian) indicates warm and cool fluctuations as depicted by the mixture of Tethyan and Austral species within the Transitional realm, varying abundances of warm and cool water

elements, fluctuations in the species diversity, equitability and climatic curve values, with a pronounced negative peak during latest Campanian, representing the coolest interval of the late Santonian to Maastrichtian as reflected by the preponderance of cool indices, low species diversity and equitability and high negative values in the paleoclimatic curve, and Interval 3 (late Maastrichtian) which marked another warm interval due to a shift in the dominance of the cool indices to warm indices, high diversity and equitability and high positive values in the paleoclimatic curve. Such results imply that paleoclimatic conditions in the Southern Hemisphere during late Santonian to Maastrichtian are very unstable. This instability could be attributed to an interplay of several geologic and tectonic events (i.e. breakup of the southern Gondwanaland continents; seafloor spreading and subsidence between Antarctica, Australia, and New Zealand; northward drift of South America from the Antarctic Peninsula ;global rise in sea level during the middle Campanian; and opening, reemergence and closure of gateways) which occurred in the Southern Hemisphere before, during, and after the identified paleoclimatic intervals. These events brought about major paleogeographic changes that greatly affected and influenced major surface water circulation as well as paleoclimatic conditions as implied by: (1) variations in the faunal composition and abundance of the planktonic foraminifera in the Southern Hemisphere sites from low, middle and high latitude, (2) fluctuations in the species richness, diversity, and equitability of the planktonic foraminifera, (3) varying influences of the different biogeographic realms, (4) the segregation of water masses which led to the development of endemic species, and (5) identification of paleoclimatic events during the late Santonian to Maastrichtian period.

To summarize, the paleoclimatic conditions through the late Santonian-early Campanian from the sites under study fluctuated from warm-Tethyan (Holes 516F, 761B and 762C) and warm-Transitional (Site 511) during the late Santonian; warm-Tethyan (Hole 516F) and warm-Transitional (Holes 758A, 761B, 762, and Site 511) during early Campanian; Tethys (Hole 516F), Transitional with varying Tethyan and Austral influences (Holes 758A, 761B and 762C), and broadly cool-Austral in character (Site 511) during the late Campanian to middle Maastrichtian; and Tethys (Holes 516F), Tethys with Transitional influence (Holes 758A and 761B) and Transitional with pronounced Tethyan influence (Hole 762C) during the late Maastrichtian.

A new species *Globotruncanella saitoi,* which is found in the Campanian-Maastrichtian of the middle latitude sites is described. The recognition of which, the first to be reported as endemic to the Transitional realm clearly define the segregation of middle latitude water mass during Campanian to Maastrichtian time.

Key words: Biostratigraphy, Late Cretaceous (late Santonian to Maastrichtian), planktonic foraminifera, Southern Hemisphere, Tethyan, Transitional, Austral, paleogeography, paleoclimate.

論文審査の結果の要旨

浮遊性有孔虫は径100から400μmの大きさの石灰質の殻をもち，その殻が遺骸群集として海洋底堆積物をつくるために，海洋プランクトンの中でももっとも重要なグループとして研究が進んでいる。本論文は，恐竜時代後期の中生代に栄えた浮遊性有孔虫群集の種組成，多様度と均衡度(equitability)の変化を古気候変動の指標として，中生代の南半球の海洋古環境の変動を解析したものである。

まず，国際深海掘削計画（ＯＤＰ）によりインド洋３地点と南大西洋２地点の計５地点で掘削された海洋底コア中から，中生代白亜紀のサントニアン，カンパニアン，マーストリヒト階の約２千万年におよぶ堆積層序について，それぞれの地点を代表する密な層序間隔の試料を採集し，試料中の浮遊性有孔虫種を同定したのち，化石群集の種組成，多様度と均衡度(equitability)を解析した。これらの解析結果を，陸上に保存された海成層中からこれまで知られている白亜紀化石群集との比較により，低緯度のテーチス海と共通なTethyan,中緯度地域のTransitional,南極海域を代表するAustral Realmの群集を識別することができた。ついで，上記５地点が過去に位置した古緯度を，プレート・テクトニクス理論によって再現し，各地点で起こった古気候変動の時代的変化の様相を解析した。それによると，古気候変動の様相は，サントニアン後期からカンパニアン初期におよぶ第１期，カンパニアン後期からマーストリヒト中期にかけての第２期，マーストリヒト後期の第３期に区分される。第１期は，高い多様度のTethyan群集の広域分布で特徴づけられ温暖な気候が高緯度まで広がった時期で，第２期は，TethyanとTransitionalの混合群集が出現した冷温化の時期である。第３期は，第１期のような温暖な気候が再度南半球に戻ってきた時期である。このような化石群集が示唆する気候変動の様相は，いくつかのコアで求められた酸素同位体比変動曲線との良い対応からも支持される。

以上の成果は，本人が自立して研究活動を行うのに必要な高度の研究能力と学識を有することを示している。従って，Maybellyn Agadier Zepeda 提出の論文は博士（理学）の学位論文として合格と認める。