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Abstracts to papers presented at the L.J. Chubb Centennial Meeting, 'Palaeontology, Stratigraphy and Palaeobiogeography of the Greater Antilles', 14 – 15 November 1987

The following brief abstracts complete the papers presented at the Chubb Centennial Meeting, held at the Department of Geology, University of the West Indies, Mona, Kingston 7, Jamaica. The original stipulation was that all abstracts were to be 200 words in length at the maximum. Where this figure was exceeded, abstracts were edited by Stephen K. Donovan.

Pre-Quaternary geochronological studies in Jamaica: a review.

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Only 23 radiometric age determinations have been made on Jamaican igneous and related rocks during 1963–87. These are: granitoids 10 (Above Rocks at Zion Hill Bridge 4 and Hall Green 1, Ginger Ridge 2, Flint River 1, Guava River 1 and Pedro Bank Stock 1); Westphalia Schist 3; hornfels from Central Inlier 2; Newcastle Volcanics 2; basic dyke 2; acid dyke 1; Bath-Dunrobin basalt 1; Summerfield ignimbrite 1; and Low Layton basalt 1. Additional data are provided by five determinations from bauxite samples and one from bentonitic clay. Considering that about 32 per cent of the Jamaican rocks are suitable for radiometric age determinations, the 29 available dates are inadequate for the purposes of local and regional correlation of igneous activity within the Jamaican region and Caribbean Plate.

A critical analysis of the available data, however, suggests the following major events in the Jamaican region:

96 – 55 Ma B.P. Dominated by widespread silicic plutonism and andesite volcanism.

55 – 45 Ma B.P. Tectonism, uplift, hydrothermal alteration and localized explosive volcanism; resetting of earlier radiometric ages.

45 – 35 Ma B.P. Newcastle-type volcanism in eastern Jamaica – extensive outpouring of lavas with minor basalts.

33 – 10 Ma B.P. Deposition of limestone; no record of any igneous activity.

Around 10 Ma B.P. Local volcanic activity, isolated submarine basalt volcanism of Low Layton and uplift.

10 Ma – Quaternary No volcanic activity, uplift.

Preliminary thoughts on the correlation of the minor St James inliers, Jamaica.

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Four lithofacies are recognized within these inliers:

A: Calcareously cemented, polymict, openwork conglomerates with associated sandstones and mudstones. Subdivided into two subfacies (A1 and A2) based on grading and biota.

B: Purple-weathering siltstones and mudstones, occurring in the northern inliers.

C: Oligomict, poorly sorted, coarse volcaniclastic conglomerates with predominant hornblende andesite petrology.

D: Rudistid limestones underlying the clastic lith_ofacies.

Textural and petrological characters suggest correlation of lithofacies A with the uppermost, transgressive, polymict lithofacies of the Central Inlier. Exposures in the Seven Rivers Inlier are best correlated with lithofacies A sediments in southern St James.

The pre-mid Eocene in these inliers represents the uppermost portion of a depositional episode which started before the biohermal rudistid phase and ceased with the Yellow Limestone transgression. Marine conditions prevailed throughout the area following the last rudist biohermal phase, with lithofacies B sediments being deposited under foreshore conditions. Shallowing in the east and northeast resulted in a hiatus and deposition of lithofacies

C epiclastics. Significant uplift and erosion in the northeast marked the end of this event, resulting in turbidite sedimentation in the southeast (lithofacies A1) and concurrent wet alluvial fan/braided stream to fan delta conditions in the emergent northeast (lithofacies A2).

A standardised geological nomenclature for eastern Jamaica (poster)

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The compilation of notes to accompany 1:50 000 geological maps of eastern Jamaica has identified the need for clarification and standardisation of nomenclature. Previous research has described lithostratigraphic units from limited areas only, without any attempt at regional correlation. The present study has involoved evaluation of lithostratigraphic nomenclature and descriptions produced by earlier authors. I suggest the following nomenclature should be adopted as standard for eastern Jamaica, from oldest to youngest: Blue Mountain Group – Back Rio Grande Formation (Catalina and Back Rio Grande Members); Bellevue Group – Peak Formation (Guava River and Bellevue Porphyry Members), Provenfield Formation (Ginger House and Bath/Dunrobin Volcanic Members), and Rio Grande Formation (St Helen's Gap [Green Volcanics] and Rio Grande Limestone Members); Plantain Garden Group – Cross Pass, Bonny View and Bowden Pen Formations; Wagwater Belt Group – Clydesdale, Chepstow, Wagwater, Richmond, Halberstadt Volcanic and Newcastle Volcanic Formations; Yellow Limestone Group – Font Hill Formation; and White Limestone Super Group – Montpelier Group – Bonny Gate, Spring Garden and Sign Formations.

A diamond anniversary for Arnold and Clark.

Stephen K. Donovan, Department of Geology, University of the West Indies, Mona, Kingston 7, Jamaica.

It is 60 years since Arnold and Clark published their monograph of the Jamaican fossil echinoids. Few papers in the intervening period have added appreciably to our knowledge of the Jamaican fauna. However, Arnold and Clark were not geologists. In consequence, their monograph suffers from a lack of good stratigraphic and locality information. Many of their echinoids were either purchased from road menders or collected loose.

A provisional stratigraphic scheme has now been devised, based on about 120 species of fossil echinoid reported from Jamaica. Most previous collectors have concentrated on the Cretaceous and Eocene, so few species are known from the Paleocene and the Oligocene to Pleistocene. These stratigraphic gaps have been partially filled. Echinoid plates are known from the Paleocene. A diverse fauna is emerging from the Miocene to Pleistocene of the Coastal Group and the Pleistocene raised reefs.

There are nevertheless a number of obvious problems with the proposed scheme. Many of the Eocene genera are probably over-split taxonomically. About 20 per cent of the fauna is from an unknown stratigraphic position. Even with the recognition of common echinoids in the post-Eocene, about 85 per cent of Jamaican fossil echinoids of known stratigraphic position come from the Cretaceous and Eocene.

A more complete account of this research is given in: Donovan, S.K. 1988 (in press). A preliminary biostratigraphy of the Jamaican fossil Echinoidea: in R.D. Burke (ed.), *Proceedings of the 6th International Echinoderm Conference, Victoria, British Columbia, 23-28 August 1987,* 7 pp. Balkema, Rotterdam.

Similarities and differences in the stratigraphies of southeastern Cuba and northeastern Hispaniola: paleogeographic and tectonic implications.

Grenville Draper, Department of Geology, Florida International University, Miami, Florida 33199, USA, and J. Antonio Barros, Division of Marine Geology and Geophysics, Rosenstiel School of Marine and Atmospheric Sciences, Miami, Florida 33149, USA.

We suggest that the following units in Oriente Province, Cuba (OC), and the Cordillera Septentrional, northern Hispaniola (CSH), are equivalent, or at least closely related:

(1) The Campanian Purial Complex (OC) and the Hicotea/Puerca Gorda Schists of the Rio San Juan Complex (CSH) are composed of fine-grained mafic volcanic rocks with minor carbonates metamorphosed to blueschist and greenschist facies.

(2) The Paleocene Cobre Group (OC), a thick and extensive unit composed of several formations, and the Imbert Formation (CSH) are characterized by tuffs, minor limestones, and epiclastic conglomerates, grits and sandstones.

(3) The Maquey Formation (OC) and the Luperon and Altamira Formations (CSH) also share similar lith-

ologies and a late Eocene to early Miocene age. All formations contain siltstones, sandstones and occasional conglomerates.

Apparently, middle Miocene rocks were not deposited or preserved in either Oriente or northern Hispaniola. The late Miocene and Pliocene of the two areas were dominated by carbonate sedimentation, but the extensive reefal deposits of the Maisi and Imias Formations (OC) differ from the marls of the Villa Trina Formation and siltstones of the Gurabo and Isabel de Torres deposits in Hispaniola.

The similarities in the pre-middle Miocene litho- and biostratigraphy of units in Oriente and the Cordillera Septentrional suggest that these two areas formed a continuous terrane from the Cretaceous until (no later than) middle Miocene times (about 18 million years B.P.). At that time, the two areas began to separate by movement on the Cayman Fault. This hypothesis implies that prior to middle Miocene time, displacements must have taken place on some fault system other than the Cayman, either to the south or the north of the Oriente-Septentrional terrane.

Appeal and proposal for a revision of the stratigraphic lexicon of Jamaica.

Grenville Draper and Edward Robinson, Department of Geology, Florida International University, Miami, Florida 33199, USA.

The last stratigraphic lexicon for Jamaica was produced in 1956, but in the 30 years since its publication a great deal of progress has been made on the geology and stratigraphy of the island. The lexicon should be an essential reference for any geologist working in the island and the time is ripe for its revision. Working groups must be set up for the major stratigraphic units (e.g., Tertiary carbonates, Wagwater Group, Blue Mountain Inlier, Central Inlier, etc.) and their activities coordinated by national committee.

The labour involved in this daunting task can be considerably reduced by the application of modern information technology. We propose the use of one of the popular database programs for personal computers. A database will be demonstrated which can record the names of formations, synonyms, geographic location, lithology, thickness, fossil content, commentary and references. Such a method of compiling the lexicon makes the production of a revised version very inexpensive (laser printers can produce high-quality hard copy for offset litho printing), and future revisions can be accomplished easily and frequently. Machine-readable discs of the lexicon enable easy access to geological information. For instance, all the formations of a certain age, containing certain fossils, or composed of particular lithologies, can easily be selected.

Stratigraphy of the Blue Mountain Inlier, eastern Jamaica: review and proposed revision of nomenclature.

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The oldest rocks in the Inlier are the Mt Hibernia and Westphalia schists. Overlying Upper Campanian–Paleocene deposits show sharp lateral facies changes. Stratigraphy is best understood by assembling units into three stratigraphic groups, then discussing distribution of approximately time-equivalent formations within three geographic sectors: north central (NCS), southeast (SES) and southwest (SWS).

Corn Husk Group (Upper Campanian): an unnamed volcaniclasitc conglomerate capped by the Back Rio Grande Formation, a biostromal limestone. Only exposed in NSC.

Blue Mountain Volcanic Group (Upper Campanian–Lower Maastrichtian): thin limestones of the Guava River Formation (NCS, SWS) are overlain by andesitic rocks of the Bellevue and Green River Formations (= 'Blue Mountain Volcanic Group', 'Green Volcanics','Provenfield Formation'). The Wild Cane Complex, Garbrand Hall Volcanics and Bath-Dunrobin Formations (SES) are lateral equivalents of the Bellevue Formation. The uppermost units in the group are the shallow water Rio Grande Formation (NCS) and the deep water Bath Limestone (SES).

Grand Ridge Group (Maastrichtian - ?Lower Paleocene): consists at its base of tuffs and epiclastics of the Spanish River Formation (='Purple Volcanics', 'Peak Formation') and the andesites of the Bonny View Formation (SWS, northern and western NCS). Shales of the Providence and Cross Pass Formations occur in the SES and southern Rio Grande Valley. The Providence and Cross Pass Formations may grade into the Moore Town Shales (Paleocene), which underlie the Nonsuch Limestone.

Stable isotopes in mollusc shells.

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Analysis of the stable isotopes of oxygen (and, to a lesser extent, carbon) in terrestrial mollusc shells shows that the ratio of the various isotopes relates primarily to the environmental variables of temperature and humidity. This relationship between the shell and the environment assumes that isotopic equilibrium has been reached and, therefore, that the effect of ambient temperature and humidity in the snail's habitat may be measured as the isotopic fractionation between the dissolved oxygen in the environmental water and the oxygen held in the carbonated snail shell.

Preliminary isotopic data on a variety of Jamaican terrestrial snails (including both prosobranchs and pulmonates), from the driest coastal habitats to the very wet cockpit country, will be presented to show some of the environmental information that may be gained from modern shell material. Further collection of Jamaican snails is to be carried out across country, through a variety of sub-environments, in conjunction with systematic sampling of river water and local precipitation available to the snails. Local meteorological data will also be utilized in the interpretation.

With a wider field data base, and with the addition of laboratory-based, temperature- and humidity-controlled growth experiments (at present under way here in Liverpool), it is hoped that this technique will be applicable to interpreting Recent and Pleistocene fossil climatic changes on Jamaica and elsewhere.

Adaptive radiation of rudistids in Cretaceous carbonate platform environments.

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Controversy exists regarding mechanisms for Cretaceous rudistid (Bivalvia; Hippuritacea) displacement of coral-algal palaeocommunities and their eventual dominance of carbonate platforms. A biological hypothesis centres on evolutionary modifications of rudistids convergent on coral morphotypes (cementation, uncoiling and erect growth, pseudocoloniality and strong aragonitic shells with porous walls, allowing rapid growth). Primitive rudistids (Diceratidae, Requieniidae, Monopleuridae) were dominantly calcitic, without wall pores, recumbent to suberect, and formed loosely packed biostromes of low relief in lagoonal and quiet platform environments. Their large body cavities resulted in an average shell porosity of 40 per cent. More advanced middle and late Cretaceous rudistids were dominantly aragonitic, with porous walls and suberect to erect pseudocolonial growth modes; these constructed reefoid frameworks. Their shell porosity increased to an average of 60 per cent in Albian-Turonian time with the evolution of large, poorly to moderately well-organised wall pores in Caprotinidae and Caprinidae. Average shell porosity decreased slightly in the later Cretaceous, with a decrease in pore size and an increase in complexity of pore wall structure in Hippuritidae and Radiolitidae. These evolutionary changes produced strong, porous, rapidly growing aragonitic shells with erect, pseudocolonial growth modes that were potentially competitive with coral-algal paleocommunities in Cretaceous reef and associated carbonate platform environments.

Ecological patterns of rudistid framework evolution.

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Rudistid bivalves (Hippuritacea) ecologically dominated tropical Cretaceous carbonate platforms and spread widely into siliciclastic facies and subtropical habitats. From late Jurassic-Neocomian habitation of quiet water lagoonal-inner platform settings by primitive recumbent and semi-faunal forms, the rudistids radiated rapidly into diverse reefoid and platform habitats with evolutionary development of oyster- and coral-like growth forms, rapid growth strategies and pseudocolonial lifestyles during Barremian-Cenomanian time. Rudistids ecologically 'displaced' coral-algal communities in most habitats, and in all stages of ecological succession, in tropical Tethys. However, this displacement proceeded at different rates in different areas of Tethys and was faster in the core tropics than in marginal areas where coral-algal communities were important in framework building into the Cenomanian. Three hypotheses are proposed to explain rudistid takeover of tropical platform and reefoid environments: (1) competitive displacement due to new morphological adaptations and rapid growth among rudists; (2) biochemical competition; (3) major changes in Tethyan environments favoring rudistids. Evidence exists for all hypotheses and composite causes are proposed. Environmental changes may have been associated with the establishment of a warmer, more saline Supertethyan climatic zone during much of the Cretaceous; cooling and disappearance of this zone may be associated with tropical phases of stepwise mass extinction.

The demise of the Jamaican virgin?

D. Timothy J. Littlewood, Department of Zoology, and Stephen K. Donovan, Department of Geology, University of the West Indies, Mona, Kingston 7, Jamaica.

Biological evidence suggests that the oysters *Crassostrea virginica* and the smaller *C. rhizophorae* are conspecific. This paper compares dense, monospecific life accumulations of Pliocene *C. virginica* found in Round Hill, Clarendon, with Recent *C. rhizophorae* populations found in Bowden, St Thomas, to investigate further the possibility that these oysters are ecophenotypes of one species.

Of the eight fossil beds described, six contain disarticulated or *in situ* shell deposits. One thick bed, exposed over 90 m of coastline, contains *in situ* oysters up to 400 mm in height. *C. virginica* lived in shallow water with few other species.

C. rhizophorae lives predominantly in the intertidal zone on mangrove roots amongst a diverse epifaunal community including many species occupying the same trophic group. Settlement area is limited by a narrow tidal range. Recruitment may be limited by severe inter- and intra-specific competition for food and space. Few mangrove oysters grow beyond 40 mm in height. This changeable environment, with abiotic and biotic factors possibly limiting the growth of individuals and the size and age of populations, contrasts with the conditions thought to be experienced by *C. virginica,* where interspecific competition seems unlikely and intraspecific competition for settlement area did not limit growth.

A more complete account of this research is given in: Littlewood, D.T.J & Donovan, S.K. 1988 (in press). *Crassostrea* in Jamaica. *Palaeontology,* 32.

Age and distribution of the Chapelton Formation, Nicaragua Rise.

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Examination of well sections on the Nicaragua Rise and outcrops in Jamaica indicates that the middle Eocene impure limestones, sandstones and clays of the so-called Yellow Limestone or Chapelton Formation of Jamaica form a unit that retains its lithological and faunal characteristics as far west as the coast of Nicaragua. Over most of the Rise the Chapelton Formation is succeeded by purer carbonates of the Eocene to Recent White Limestone Group, whereas at the western end of the Rise it is overlain unconformably by middle Tertiary clastics of probable terrestrial origin. Biostratigraphic studies using larger foraminifera indicate some variation in the age of the Chapelton Formation from place to place, with age differences apparently related to individual fault blocks. Over much of the region deposition commenced in the middle Eocene, but a few sequences, such as that on the north side of Jamaica's Central Inlier, record an early Eocene marine phase. Central Jamaica is the easternmost point on the Rise from which Chapelton facies sediments are recorded, and the faults defining the western side of the Wagwater Belt also mark the eastern boundary of the unit.

Lawrence Chubb: the last 15 years.

Edward Robinson, Department of Geology, Florida International University, Miami, Florida 33199, USA.

A brief review of Lawrence Chubb's later life in Jamaica is given, from about 1956, shortly after the founding of the Geological Society of Jamaica, through his Directorship of the Geological Survey of Jamaica, to his second retirement and subsequent work at the University of the West Indies, culminating in the publication of his monograph 'Rudists of Jamaica'.

Red Gal Ring revisited: another look at the Eocene/Oligocene boundary in Jamaica.

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In a previous publication dealing with the section through the White Limestone Group of Jamaica at Red Gal Ring, only the middle to late Eocene part, containing the Claremont and Somerset Formations, was described. This paper presents the larger foraminiferal stratigraphy of the rest of the sequence, which includes the late Eocene through early Miocene 'Gibraltar', Walderston, Browns Town, and 'Newport' Formations. The main features of the stratigraphy are the confirmations of the upper range of *Fallotella cookei* into the Walderston Formation (usually regarded as being early Oligocene) and the presence of the Mediterranean/Indo-Pacific species *Praerhapydionina delicata* in the early to middle Oligocene Browns Town Formation. Both these features have previously been recorded by McFarlane from north central Jamaica. Rocks assigned to the 'Newport' Formation are of late Oligocene to perhaps early Miocene age.

Chubb and Kugler – two great geologists in the Caribbean.

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Lawrence J. Chubb and Hans G. Kugler were both internationally known and highly respected geologists. Both made a considerable impact on Caribbean geology, but they worked geographically far apart and knew little of each other.

I first came to know Dr Chubb at University College, London, then on a memorable trip through Jamaica in 1956, and again at the Caribbean Geological Conference held in Mona in 1962.

I worked with Dr Hans Kugler in Trinidad from 1952 until 1959 and remained closely associated with him until his death in Basel last December at the age of 93.

It is interesting to consider how these two unselfish men played a part in educating and encouraging the geologists around them; for that is an even more important memorial to their names than the work that they themselves achieved.

The middle Maastrichtian faunal break in Jamaica.

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Upper Cretaceous rocks of Maastrichtian age are exposed in the inliers of western Jamaica. The Jerusalem Mountain Inlier comprises, in successive order, of volcaniclastic conglomerates, pebbly sandstones and fine grained siltstones, which are attributed to arc-related turbidite/submarine fan sedimentation. The higher stratigraphic sequence is characterized by three major limestone units intercalated with fossiliferous shales. Abundant rudist species, other bivalves, gastropods, solitary corals and echinoids classify the rock section as a near shore to shelf edge environment.

A faunal break occurs midway through the fossiliferous section with the oyster *Ostrea arizpensis jamaicensis* and other species dominating the limestones and shales. The abrupt change from a rudist-dominated fossil assemblage to oyster communities cannot be explained by catastrophic events or unconformable contacts. It is suggested that, due to changing ecological bottom conditions without interruption of deposition, rudists vanish and are replaced by oysters in middle Maastrichtian times.