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A SUMMARY OF THE OLDEST AGES FOR THE WORLD'S ISLANDS

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ABSTRACT

The oldest ages of rocks on the world's islands are summarized (Oligocene or older), based on published literature. All the oceans and perhaps all the seas contain a few continental islands, indicative of debris left from continental rifting prior to ocean basin formation by seafloor spreading. The Musicians Seamounts and the Hawaiian Ridge (both Cretaceous), and the Tuamotu Islands (Eocene) are the same age as the surrounding seafloor and probably formed at the crest of the East Pacific Rise. Future drilling and dredging operations are expected to modify and add to this list, as recent volcanism may well have obscured the much older basement rocks on many islands. Thus, the faunas of the Galapagos, Mauritius, Rodriguez, and Tristan da Cunha suggest they are continental islands, while their known surface geology yields dates of only 8 m.y. or less.

INTRODUCTION

The following is a summary of the oldest ages (i.e. Oligocene or older) of rocks on the world's islands (including some seamounts, guyots, and sunken plateaus), compiled from the literature. Especially interesting from tectonic and biogeographic considerations are islands with continental rock-types. "'Continental rocks'include plutonic rocks such as granite and diorite and metamorphic rocks such as schist and slate. As a general rule such rocks are not found except on continents or on islands obviously once connected with continents. The deep-seated plutonic rocks are exposed only after prolonged erosion and most islands have not suffered sufficient erosion even if it be assumed that they have a plutonic core. The metamorphic rocks demand powerful earth movements and these cannot be developed on tiny land masses. Hence, the occurrence of either plutonic or metamorphic rocks on an island suggests that it once was a part of a much larger land mass. The 'island rocks' consist largely of volcanic rocks and limestones and sediments derived from these" (Wentworth & Ladd 1931, p.6). According to Daly (1916a), Pacific islands having rock types characteristic of large areas in the continents include granite, gneiss, schist, serpentine, and deformed sediments (However, more recent work suggests granitic metamorphism requires diapiric transport up from significant depths and is not excluded from islands (Carey *pers. comm.*); serpentine is known to occur along some transform faults, and mid-ocean ridges (Chernysheva 1971), and it has been reported from the Puerto Rico Trench by Perfit, Heezen, and Rawson 1974.) Schists can occur in shear-zones. A continental flora or fauna means that that island resembles a continent in aspect rather than an oceanic island - i.e., the biota is not markedly impoverished, or forms are present such as land turtles, amphibians, flightless birds or the like which suggest past contacts with a continent. The distinction between oceanic and continental islands was first made by Charles Darwin; oceanic islands are volcanic or coral and lack native mammals and amphibians (Wallace 1887).

A Summary of The Oldest Ages for the World's Islands

OLDEST AGES FOR ISLANDS

Island	Latitude & Longitude	Age	Source
ATLANTIC OCEAN			
Greenland	74.00N,40.00W	continental; Archaean	Menard & Ladd 1963; Pidgeon & Hopgood 1975
Franz Joseph Land	81.00N,55.00E	Jurassic	Arkell 1956
The Faeroes Islands	61.53N,5.58W	Eocene (?)	Wilson 1963
Spitzbergen & King Charles Islands	77.00N,20.00E	Jurassic	Arkell 1956
Iceland	65.12N,19.45W	continental, or Eocene	Wilson 1963 Menard & Ladd 1963
Andoe Island (nr. Norway)	58.06N,7.59E or 65.58N,12.17F	Jurassic	Arkell 1956
Rockall Bank	57.37N,13.40W	Precambrian; continental	Roberts, Ardus, & Dearnley 1973; Roberts 1975
Rockall Islet	57.40N,13.30W	Eocene	Roberts, Ardus, & Dearnley 1973
Holy Island, N.Wales	53.45N,4.45W	Silurian/ Devonian	Harland, Smith & Wilcock 1964
Isle of Wight	50.44N,1.17W	Lower Cretaceous	Harland, Smith & Wilcock 1964
British Isles	55.34N,7.45W	continental	Carlquist 1965
Vigo Seamount off Portugal	41.14N,10.42W	Jurassic	Black *et al.* 1964
Galicia Bank off Portugal	42.40N,11.55W	Upper Cretaceous	Black *et al.* 1964
Cape Breton Island (Nova Scotia)	45.48N,59.53W	Precambrian/ Cambrian	Cromier 1973
Azores Swell		continental rocks	Axelrod 1960
Azores	37.44N,29.25W	continental	Alexrod 1960; Carlquist 1965
Madeira	32.41N,16.15W	Cretaceous (?)	Wilson 1963
Canary Islands	28.30N,15.10W	continental	Axelrod 1960; Carlquist 1965
Fuerteventura	28.25N,14.00W	continental crust; or Mesozoic	Dietz & Sproll 1970; Rothe 1974
Lanzarote	29.00N,13.38W	continental fauna; or Mesozoic	Rothe 1974

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Island	Latitude & Longitude	Age	Source
Tenerife	28.15N,16.35W	continental fauna	Rothe 1974
Cape Verde Islands	16.00N,24.00W	continental	Carlquist 1965
Maio I.	15.14N,23.10W	Upper Jurassic	Smith 1971; Mitchell-Thome 1974
Sao Nicolao Islands	16.35N,24.15W	Upper Jurassic (?)	Mitchell-Thome 1974
Conception Bank	23.55S,14.30E	continental crust	Dietz & Sproll 1970
Fernando Poo	3.22N, 7.37E	Cretaceous (?)	Mitchell-Thome 1970
Principe	1.42N, 5.38E	end of Cretaceous (?)	Mitchell-Thome 1970
Sao Tome	0.41N, 6.01E	Lower Cretaceous (?)	Mitchell-Thome 1970
Annobon	2.00S, 3.30E	Cretaceous (?)	Mitchell-Thome 1970
Bermuda	32.18N,64.45W	Eocene, pre-Eocene, or Triassic (?)	Reed 1949; Wilson 1963; Engelen 1964, Reynolds 1973
Bahamian Platform		Jurassic; or Palaeozoic (?)	Lynts 1970
Bahamas	26.15N,76.00W	Early Cretaceous	Wilson 1963
Demerara Plateau (off South America)	9.26N,54.06W	Late Jurassic/ Early Cretaceous	Fox, Heezen, & Johnson 1970
St. Peter & St.Paul Rocks	0.56N,29.22W	4550+ m.y.	Wright 1965
Fernando de Noronha	3.50S,33.15W	Upper Cretaceous	Mitchell-Thome 1970
Ascension	8.00S,13.00W	continental rocks (?)	Alexrod 1960; Carlquist 1965; Mitchell-Thome 1970
St. Helena	16.01S, 5.16W	Eocene	Mitchell-Thome 1970
Walvis Ridge		continental rocks	Axelrod 1960
Trinidade	21.00S,32.00W	continental rocks	Axelrod 1960
Martin Vaz	20.30S,28.52W	Upper Cretaceous	Mitchell-Thome 1970
Tristan da Cunha	35.30S,12.15W	continental	Axelrod 1960; Carlquist 1965
Meteor Bank		continental rocks	Axelrod 1960

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Island	Latitude & Longitude	Age	Source
Falkland Islands	50.45S,61.00W	Precambrian	Mitchell-Thome 1970
islands of the North & South Scotia Ridges		continental rocks (?Palaeozoic or older)	Dalziel 1972
South Georgia	54.00S,37.00W	continental; or Jurassic/ Cretaceous	Axelrod 1960; Carlquist 1965; Elliot 1975
South Orkneys	60.38S,45.30W	continental; Precambrian	Alexrod 1960; Carlquist 1965; Elliot 1975
Signy I.	60.43S,45.36W	176-199 m.y.	Alexrod 1960; Carlquist 1965
Moe I.	60.45S,45.41W	176-199 m.y.	Axelrod 1960; Carlquist 1965
South Shetlands	62.00S,58.00W	continental; or Late Palaeozoic	Axelrod 1960; Carlquist 1965; Elliott 1975
Alexander Island	71.00S,71.00W	Late Palaeozoic	Elliot 1975
Northern Antarctic Peninsula		Middle Palaeozoic	Elliot 1975
MEDITERRANEAN SEA			
Gilbraltar	36.08N, 5.22W	Jurassic (?)	Reed 1949
Minorca	40.00N, 4.00E	Palaeozoic	Arkell 1956
Mallorca (Majorca)	39.30N, 3.00E	Palaeozoic	Arkell 1956
Corsica	42.10N, 8.55E	Upper Palaeozoic	Arkell 1956; Klemme 1958
Sardinia	40.08N,9.05E	Lower Palaeozoic	Arkell 1956; Klemme 1958
Island of Elba	42.42N,10.25E	Upper Jurassic	Grunau 1965
Sicily	37.38N,13.30E	Upper Palaeozoic	Klemme 1958
Maltese Islands	36.00N,14.15E	Oligocene	Reed 1949
Crete	35.15N,24.30E	Upper Palaeozoic	Klemme 1958
Cyprus	34.56N,31.28E	Upper Palaeozoic	Reed 1949; Klemme 1958
Ionian Isles	39.10N,20.05E	Jurassic	Arkell 1956

Island	Latitude & Longitude	Age	Source
INDIAN OCEAN			
Bahrain Islands (Persian Gulf)	26.15N,51.17E	Cretaceous	Reed 1949
Socotra	13.00N,52.30E	continental; Archaean	Forbes 1903; Van Balgooy 1969
Abd-El-Kuri	12.21N,51.00E	Archaean	Forbes 1903
Ceylon	8.45N,82.30E	Precambrian	Reed 1949; Crawford & Oliver 1969; Katz 1971
Laccadive, Maldive, & Chagos Islands		continental crust (?)	Axelrod 1960
Seychelles	5.20S,55.10E	Precambrian	Wilson 1963
Mahe	4.41S,55.30E	645 ± 55 m.y.	Baker & Miller 1963
Silhouette Is.	4.29S,55.12E	62 ± 12 m.y.	Baker & Miller 1963
Praslin	4.18S, 55.45E	647 ± 55 m.y.	Baker & Miller 1963
Northern end of the Mascarene Ridge & Cargados Carajos Shoals		continental crust	Matthews & Davies 1966
Mauritius	20.18S,57.36E	continental rocks; or Cretaceo-Tertiary	de Haga Haig 1895; Axelrod 1960; Carlquist 1965; Simpson 1950
Providence	9.14S,51.02E	Eocene/Oligocene	Reed 1949; Wilson 1963
Comores Islands	11.46S,44.12E	continental rocks	Axelrod 1960; Carlquist 1965; Flower & Strong 1969 (but see Wright & McCurry 1970)
Madagascar	21.30S,46.00E	Precambrian	Wilson 1963
St. Paul	38.43S,77.31E	continental rocks	Axelrod 1960; Carlquist 1965
Kerguelen	49.50S,69.30E	continental rocks; or Upper Cretaceous-Palaeocene	Axelrod 1960; Carlquist 1965; Nougier 1972
Heard Island	53.10S,74.35E	continental rocks; or Lower Tertiary	Axelrod 1960; Stephenson 1963
Crozet (Possession) Island	46.20S,51.30E	continental rocks	Axelrod 1960; Carlquist 1965

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Island	Latitude & Longitude	Age	Source
Andamans-Nicobars	11.38N,92.17E	continental crust	Peter, Weeks & Burns 1966
Andaman Island	11.41N,92.46E	Eocene (?)	Glaessner 1943
Christmas	10.35S,105.40E	continental; or Eocene	Marshall 1927; Wilson 1963; Van Balgooy 1969
Wallaby Plateau		continental crust	Geomagnetism Correspondent 1973
Exmouth Plateau		continental crust	Geomagnetism Correspondent 1973
Naturaliste Plateau		continental crust	Petkovic 1975
Broken Ridge		continental crust	Petkovic 1975
INDONESIA-PHILIPPINES			
Langkawi Island	6.22N,99.50E	Palaeozoic	Katili 1971
Riouw Archipelago	0.49N,103.45E	Triassic	Umbgrove 1938
Sumatra	2.06N,99.40E	continental rocks	Woolnough 1903; Umbgrove 1949; Carlquist 1965
Java	8.35S,111.11E	continental crust (?)	Woolnough 1903; Cloud 1953
Bali	8.00S,115.22E	continental	Carlquist 1965
Timor	10.08S,125.00E	Permian	Umbgrove 1949
Letti Island	8.12S,127.41E	Permian	Umbgrove 1949
Billiton Island	2.50S,107.56E	Triassic/ Jurassic	Harland, Smith & Wilcock 1964
Barbar, Moa, Sawu, Rotti		Permian	Umbgrove 1949
Jamdena	7.23S,130.30E	Jurassic	Umbgrove 1938
Bathurst Island	11.35S,131.41E	Cretaceous	Wright 1963
Tambelan & Bunguran Islands	0.38N,107.38E	Late Cretaceous	Haile & Bignell 1971
Tanimbar, Boeton, Boeroe, Ambon, Banka, Billiton, Rendjoewa, Savoe, Misool, the Moluccas		Triassic	1938

Island	Latitude & Longitude	Age	Source
Borneo	0.25N,112.39E	continental crust (?)	Woolnough 1903; Reed 1949; Cloud 1953
Celebes	2.15S,120.30E	Triassic	Umbgrove 1949
Soela Islands	2.20S,125.20E	end of Palaeozoic (?)	Umbgrove 1938
Kei Islands	5.35S,132.45E	Eocene	Glaessner 1943
Ceram	3.00S,129.00E	Triassic	Grunau 1965
Buru	3.30S,126.30E	Jurassic	Arkell 1956
Obi	1.25S,128.15E	Jurassic	Umbgrove 1949
Halmahera	0.45N,128.45E	Cretaceous	Umbgrove 1938
Philippines	14.25N,125.00E	continental crust (?), in part	Cloud 1953; Carlquist 1965
Mindanao	7.30N,125.10E	continental rocks	Irving 1952
Negros	9.50N,121.45E	continental rocks	Irving 1952
Cebu	10.22N,123.49E	Cretaceous (?)	Irving 1949
Palawan	9.50N,117.38E	continental rocks	Irving 1952
Mindoro	13.04N,121.06E	Jurassic (?)	Irving 1949; Arkell 1956
Luzon	17.10N,119.45E	continental rocks	Irving 1952
BERING SEA			
St. Matthew Island	60.25N,172.10W	Upper Cretaceous	Patton, Lanphere, Miller, & Scott 1974
PACIFIC OCEAN			
Eastern edge of Pacific			
I. Alaskan Peninsula:			
Aleutian Islands	52.40N,177.30E	latest Cretaceous, early Tertiary, or Early Oligocene	Burk 1965; Scholl, Marlow, & Buffington 1975
guyot in Aleutian Trench		early Tertiary or older	Wilson 1963
Adak Island	51.40N,176.28W	Permian	Packham & Falvey 1971
outer Shumagin Islands	55.22N,159.20W	Upper Cretaceous	Burk 1965

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Island	Latitude & Longitude	Age	Source
Sanak Island	54.26N,162.40W	Upper Cretaceous	Burk 1965
Semidi Is. & Chirikof Is.	55.50N,155.35W	Late Mesozoic	Burk 1965
Kodiak Islands	57.24N,153.32W	Palaeozoic	Burk 1965
II. San Juan Is., Washington			
San Juan Islands	48.30,123.05W	Devonian	McLellan 1927
III Channel Islands			
San Miguel I.	34.03N,120.23W	Late Cretaceous	Weaver 1969
Santa Rosa	34.02N,120.15W	Eocene	Weaver 1969
Santa Cruz I.	34.05N,119.55W	Late Jurassic	Weaver 1969
San Nicolas	33.14N,119.10W	Eocene	Weaver 1969
Santa Catalina I.	33.29N,118.37W	continental rock	Van Balgooy 1969
IV. Gulf of California			
San Lorenzo I., Angel de la Guarda I., Tiburon I., San Pedro Nolasco I., Consag Rock, Santa Catalina I., Santa Cruz I., San Diego I., San Jose I., & Cerralvo I.		pre-Tertiary basement	Anderson 1950
V. off the South American coast			
Galapagos Islands	0.10S,87.45W	continental biota	Baur 1897
San Felix & San Ambrosio	26.40S,80.00W	continental flora	Kuschel 1963
Juan Fernandez	33.30S,79.00W	continental biota	Kuschel 1963
Northwest Pacific margin			
Kamchatka-Kuril-Hokkaido Arc		continental	Menard & Ladd, 1963
Sakhalin	51.52N,144.15E	continental	Carlquist 1965
Japan	36.30N,133.30E	continental	Carlquist 1965
Ryukyu Islands	26.00N,119.00E	continental (?)	Cloud 1953

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Island	Latitude & Longitude	Age	Source
Taiwan	23.30N,122.20E	continental	Cloud 1953; Carlquist 1965
West Pacific			
Bonin Islands	27.00N,142.10E	Middle Eocene	Cloud 1953; Karing 1971; Karig *et al.*, 1973; Karig & Moore 1975
Southern Marianas	17.20N,145.00E	Eocene	Cloud 1953
Saipan	15.12N,145.43E	Middle Eocene	Hanzawa 1957; Cole 1963; Tracey *et al.* 1964; Karig *et al.* 1973
Tinian	14.58N,145.38E	Eocene	Hanzawa 1957
Rota	14.10N,145.15E	Eocene	Hanzawa 1957
Guam	14.00N,143.20E	Middle Eocene	Cole 1963; Tracey *et. al.* 1964; Karig *et. al.* 1973
Magellan Rise		Upper Jurassic	Larson & Chase 1972
Yap	11.00N,138.00E	continental rocks (?)	Daly 1916; Gregory 1928, 1930
Palau Islands	7.15N,134.30E	Middle Eocene	Cloud 1953; Hanzawa 1957; Karig *et al.* 1973
Babelthuap	7.30N,134.36E	continental rocks or Late Eocene	Daly 1916; Mason & Corwin 1953; Hanzawa 1957
Malakal	7.20N,134.28E	continental rocks	Marshall 1911
West Carolines	9.30N,143.00E	continental flora	Van Balgooy 1969
Truk	7.28N,151.51E	continental	Daly 1916; Gregory 1928 (but see Bridge 1948)
Maprong		continental	Gregory 1928
Ponape	6.55N,158.15E	Eocene/Oligocene	Van Balgooy 1969
Map	9.35N,138.11E	continental rocks	Daly 1916
Southwest Pacific			
Ontong Java Plateau (= Solomon Rise)		Late Cretaceous	Hammond *et al.* 1975
New Guinea	5.45S,140.00E	continental rocks	Reed 1949; Umbgrove 1949
Bismarck Archipelago	3.15S,150.45E		
New Britain	6.45S,149.38E	Cretaceous (?)	Reed 1949
New Ireland	3.15S,152.30E	Lower Oligocene	Reed, 1949

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Lou	2.25S,147.23E	continental rocks	Daly 1916
Macada		continental rocks	Daly 1916
New Hanover	2.37S,150.15E	continental rocks	Daly 1916
New Mechlenburg		continental rocks	Daly 1916
Solomon Islands	7.00S,148.00E	continental	Baur 1897; Griffiths 1971
Guadalcanal	9.48S,158.43E	continental rocks	Grover 1955
San Cristobal	10.47S,162.17E	continental rocks	Reed 1949; Grover 1955
St. George	8.30S,159.36E	continental rocks	Grover 1955
Vulavu	8.31S,159.48E	continental rocks	Woolnough 1903
Faro (Fauro)	6.55S,156.05E	continental rocks	Daly 1916
Shortland Islands	7.05S,155.45E	continental rocks	Daly 1916
Savo I.	9.10S,159.50E	Lower Cretaceous	Coleman 1970
Russell I.	9.16S,158.30E	Lower Cretaceous	Coleman 1970
Choiseul	7.30S,157.30E	51.5 m.y.	Richards *et al.* 1966
Malaita	8.38S,161.15E	Upper Cretaceous	Coleman 1966b, 1970
Malaita group		Oligocene or older (?)	Univ. Sydney 1956
Central Province - (Bougainville, Choiseul, Santa Ysabel, Florida Group, Guadalcanal, San Cristoval)		Mesozoic (probably Cretaceous) basal complex	Coleman 1966a
San Jorge	8.27S,159.35E	pre-Tertiary (?)	Univ. Sydney 1956
Florida I	9.05S,160.15E	continental rocks	Marshall 1911
Santa Ysabel	8.00S,159.00E	pre-Tertiary (?)	Univ. Sydney 1956; Stanton 1961
Louisiade Ridge		continental crust	Griffiths 1971
Rennell Ridge		continental crust	Griffiths 1971
Queensland Plateau		continental crust	Griffiths 1971

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Island	Latitude & Longitude	Age	Source
New Hebrides	16.02S,169.15E	continental mass	Reed 1949
Malicolo	16.15S,167.30E	continental rocks	Woolnough 1903
Spiritu Santo	15.15S,166.50E	continental rocks	Woolnough 1903
Aneityum	20.15S,169.49E	continental rocks	Woolnough 1903
Malekula	16.44S,167.45E	continental rocks (?)	Daly 1916
Maewo	15.17S,168.16E	Upper Eocene	Coleman 1969, 1970
New Caledonia	21.30S,165.30E	Precambrian; continental rocks & flora; or Permian flora	Aronson & Tilton 1971; Marshall 1911; Avias 1953; Carlquist 1965; Van Balgooy 1969; Waterhouse 1971
Fiji Archipelago	18.50S,175.00E	continental rocks & flora	Woolnough 1903; Axelrod 1960; Van Balgooy 1969
Vanua Levu	16.33S,179.15E or 17.28S,177.03E	continental rocks	Marshall 1911; Daly 1916
Viti Levu	18,00S,178.00E	continental rocks; or Upper Eocene	Marshall 1911; Daly 1916; Cole 1960
Lau	18.20S,178.30W	Eocene	Cole 1963
Wallis Islands	13.16S,176.15W	Oligocene	Wilson 1963
Tonga Islands	18.50S,175.20W	continental mass & flora	Reed 1949; Van Balgooy 1969
Eua I.	21.23S,174.55W	continental rocks	Lister 1891; Daly 1916; Reed 1949
Kermadec Islands	30.30S,177.00E	continental rocks (?)	Marshall 1911; Gregory 1930; Axelrod 1960
Lord Howe Rise		continental crust; or Upper Cretaceous	Officer 1955; Griffiths 1971; Packham & Falvey 1971; McDougall & Van Der Lingen 1974
Lord Howe Island	31.44S,157.56E	continental rocks (?) & flora	Marshall 1911; Reed 1949; Standard 1963; Van Balgooy 1969
Norfolk Ridge		continental crust	Griffiths 1971
Norfolk Island	29.05S,167.59E	continental rocks	Daly 1916a
New Zealand	39.14S,169.30E	Precambrian	Reed 1949; Aronson 1965; Aronson & Tilton 1971

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Island	Latitude & Longitude	Age	Source
Three Kings Islands (N. New Zealand)	34.09S,172.09E	Cretaceous	Bartrum 1948
Chatham Rise		continental crust	Griffiths 1971
Chatham Islands	44.00S,178.00W	continental rocks	Axelrod 1960; Carlquist 1965
Campbell Plateau		continental crust	Adams 1962; Griffiths 1971
Campbell Island	52.30S,169.00E	continental rocks	Axelrod 1960; Carlquist 1965
Bounty Islands	47.42S,179.05E	continental rocks; or Triassic/ Jurassic	Axelrod 1960; Wasserburg *et al.* 1963; Carlquist 1965
The Snares	48.00S,116.30E	continental rocks	Daly 1916
Auckland Islands	50.30S,166.30E	continental rocks	Daly 1916; Axelrod 1960
Disappointment	50.35S,166.00E	continental rocks	Daly 1916
Macquarie Island	54.36S,158.45E	continental rocks	Axelrod 1960; Carlquist 1965
Tasmania	41.28S,142.30E	Precambrian	Reed 1949
Marie Byrd Land	78.00S,140.00W	Precambrian	Elliot 1975
Northwest to Southeast Pacific			
Shatsky Rise		Lower Cretaceous	Larson & Chase 1972; Douglas & Moullade 1972
Koko Seamount	34.47N,171.50E	Eocene (46.4 m.y.)	Clague & Dalrymple 1973
Suiko Seamount		41 m.y.	Jackson, Silver, & Dalrymple 1972
Khatchaturian Seamount	28.08N,162.17W	65 ± 3 m.y.	Clague & Dalrymple 1975
Rachmaninoff Seamount	29.33N,163.22W	87 ± 5 m.y.	Clague & Dalrymple 1975
Wentworth Seamount	28.54N,177.52W	71 ± 5 m.y.	Clague & Dalrymple 1975
Necker Island	23.48S,164.25W	78 ± 2 m.y.	Clague & Dalrymple 1975
3 seamounts SW of the Hawaiian Islands		Cretaceous (85-90 m.y.)	Dymond & Windom 1968
Line Islands	0.05N,157.00W	Upper Cretaceous	Schlanger *et al.* 1974a, b

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Islands	Latitude & Longitude	Age	Source
Horizon Guyot	19-20N,169.00W	Eocene	Hamilton 1956
Kapsitotwa Seamount		128 m.y.	Clague & Dalrymple 1975
Guyot 19171	23.00N, 00W	Lower Eocene	Hamilton 1956
Hess Guyot	17.50N,174.15W	Middle Cretaceous	Hamilton 1956
Cape Johnson Guyot	17.08N,177.15W	Middle Cretaceous	Hamilton 1956
Shepard, Jacqueline, & Menard seamounts or guyots		88-100 m.y.	Clague & Dalrymple 1975
guyots in the northern Marshall area		Late Mesozoic	Emery, Tracey, & Ladd 1954
Marshall Islands	10.00N,165.00E	Upper Eocene	Coleman 1969
Eniwetok	11.21N,162.20E	Late Mesozoic (?) or Late Eocene	Cloud 1953; Hamilton 1956; Cole 1963; Tracey *et al.* 1964
Bikini	11.35N,165.20E	Eocene; or Oligocene (?)	Emery, Tracey, & Ladd 1954; Hanzawa 1957; Cole 1963
Sylvania Guyot		Lower Eocene	Wilson 1963
Cook Islands	20.00S,158.00W		
Mauke	20.09S,157.23W	Cretaceous; or Early Tertiary	Wood & Hay 1970
Mitiaro	19.49S,157.43W	Cretaceous; or Early Tertiary	Wood & Hay 1970
Atiu	20.00S,158.07W	Cretaceous; or Early Tertiary	Wilson 1963; Wood & Hay 1970
Aitutaki	18.52S,159.46W	Cretaceous; or Early Tertiary	Wilson 1963; Wood & Hay 1970
Mangaia	21.56S,157.56W	end of Cretaceous; or Eocene; or Oligocene	Marshall 1927; Gregory 1930; Wood 1967; Wood & Hay 1970
Rarotonga	20.40S,163.00 W	Cretaceous	Marshall 1930
Northern Group atolls		Early Tertiary	Wood & Hay 1970
Manihiki Plateau		Cretaceous	Schlanger *et al.* 1974b

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Island	Latitude & Longitude	Age	Source
Tubuai Islands	23.23S,149.27W		
Rimatara	22.40S,152.45W	continental rocks	Williams 1933; Wood & Hay 1970
Tubuai	23.23S,149.27W	25 ± 10 m.y.	Krummenacher & Noetzlin 1967
Rapa	27.36S,144.20W	continental rocks & flora	Williams 1933; Wilson 1963 Van Balgooy 1969; Woods & Hay 1970
Society Islands	17.00S,150.00W		
Maupiti	16.27S,152.15W	continental rocks (?)	Gregory 1930
Bora-Bora	16.30S,151.45W	continental rocks (?)	Marshall 1911; Daly 1916
Moorea	17.32S,149.50W	continental rocks (?)	Wilson 1963
Tahiti	17.30S,149.30W	continental rocks; 833 m.y.; or 156 ± 15 m.y.	Wilson 1963; Krummenacher & Noetzlin 1967; Krummenacher *et al.* 1972
Tahiti-Iti	17.47S,149.14W	continental rocks	Wilson 1963
Tuamotu Ridge		pre-early Eocene	Schlanger *et al.* 1974a
Tuamotu Islands	19.00S,142.00W		
Makatea	15.50S,148.15W	Eocene	Wilson 1963
guyot amid the atolls of the Tuamotu Archipelago		Eocene	Menard & Ladd 1963
guyots among the Tuamotu Islands		40 - 45 m.y.	Vogt & Ostenso 1967
Marquesas Islands	8.50S,141.00W	continental rocks (?)	Gregory 1930
Easter Island	26.50S,109.00W	continental rocks (?)	Marshall 1911; Daly 1916; Stearns 1945, p.617; King 1962 p.606, 609
Sala-y-Gomez	26.28S,105.28W	continental rocks	King 1962, p.606

Island	Latitude & Longitude	Age	Source
CARIBBEAN--GULF OF MEXICO			
Cuba	22.00N,79.00W	Palaeozoic (?); or Middle Jurassic	Schuchert 1935; Weyl 1966
Isla de Pinos	21.40N,82.50W	Late Palaeozoic or Mesozoic	Weyl 1966; Baie 1970
Cayman Ridge & Nicaragua Rise		continental crust	Khudoley & Meyerhoff 1971
Jamaica	18.21N,77.31W	Palaeozoic (?); or pre-Cretaceous; or Upper Cretaceous	Schuchert 1935; Reed 1949; Harland, Smith & Wilcock 1964; Weyl 1966
Hispaniola	17.30N,73.15W	Palaeozoic or Mesozoic	Weyl 1966
Haiti		Palaeozoic (?); or Lower Cretaceous	Schuchert 1935; Butterlin 1956
Santo Domingo		pre-Jurassic (?)	Khudoley & Meyerhoff 1971
Puerto Rico	17.45N,66.55W	pre-Jurassic (?); or Lower Cretaceous	Butterlin 1956; Khudoley & Meyerhoff 1971
Virgin Islands	18.20N,64.45W	Cretaceous	Hess 1937
Culebra	18.19N,65.32W	early Upper Cretaceous	Donnelly 1971
St. Thomas	18.22N,64.57W	pre-Upper Cretaceous	Christman 1953; Donnelly 1971
St. John	18.16N,64.48W	pre-Upper Cretaceous	Donnelly 1971
St. Croix	17.40N,64.43W	Late Cretaceous	Khudoley & Meyerhoff 1971
Ginger Island,		pre-Cretaceous	Reed 1949
Cooper's Island,			
Salt Island (small islets in Virgin Is.)			
Anguilla	18.15N,62.54W	Middle Eocene	Reed 1949
St. Martin	18.06N,62.54W	Cretaceous (?)	Maxwell 1948

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Island	Latitude & Longitude	Age	Source
St. Barthelemy	17.55N,62.32W	Middle Eocene (?)	Christman 1953; Martin-Kaye 1969
The "Limestone Caribbees" (Sombrero, Anguilla, St.Martin, Tintamarre, St. Barthelemy, Barbuda, Antigua, Grande Terre of Guadeloupe, Desirade, & Marie Galante)		Eocene or older	Maxwell 1948; Martin-Kaye 1969
Saba, St. Eustatius, St. Kitts, Gaudeloupe, Dominica, Martinique, St. Lucia, St. Vincent, & Grenada		ejected fragments of continental basement	Westermann & Kiel 1961, p.168
"Volcanic Caribbees" (from Saba in the north to Grenada in the south)		Eocene	Weyl 1966
Windward Islands (from Dominica to Grenada)		basement of trappean rocks beneath early Tertiary formations	Spencer 1902
Antigua	17.07N,61.32W	pre-Cretaceous (?)	Reed 1949
Montserrat	16.48N,62.00W	Late Cretaceous (?) or Early Eocene	Reed 1949
Desirade	16.21N,60.51W	Jurassic or older	Meyerhoff 1974
Dominica	15.24N,61.05W	pre-Tertiary (?); or Eocene	Earle 1928; Reed 1949
Martinique	14.30N,60.37W	Cretaceous	Hill 1905; Hess 1937
Bequia	13.00N,61.08W	Eocene (?)	Martin-Kaye 1969
Mustique	12.53N,61.03W	Lower Eocene (?)	Martin-Kaye 1969
Canouan	12.44N,61.10W	Upper Eocene (?)	Martin-Kaye 1969
Mayreau	12.39N,61.23W	Lower Eocene (?)	Martin-Kaye 1969
Carriacou	12.28N,61.20W	Upper Eocene	Martin-Kaye 1969
Petit Martinique	12.30N,61.25W	Upper Eocene	Martin-Kaye 1969

Island	Latitude & Longitude	Age	Source
Grenada	12.02N,61.27W	Upper Eocene	Martin-Kaye 1969
Barbados	13.30N,59.48W	Early Eocene	Maxwell 1948; Christman 1953; Weyl 1966
Tobago	11.15N,60.30W	Cretaceous	Christman 1953; Butterlin 1956
Trinidad	10.30N,60.30W	Jurassic	Christman 1953; Butterlin 1956
Patos Island	10.36N,61.54W	Early Cretaceous	Kugler 1974
Margarita	11.00N,64.15W	Mesozoic; or Cretaceous (?)	Butterlin 1956; Weyl 1966
Bonaire	12.10N,68.15W	Upper Cretaceous	Maxwell 1948; Butterlin 1956
Curacao	12.12N,68.58W	Upper Cretaceous	Maxwell 1948; Butterlin 1956
Aruba	12.29N,70.00W	Upper Cretaceous	Maxwell 1948; Butterlin 1956
Gran Roque	11.50N,66.45W	Upper Cretaceous (?)	Butterlin 1956
Los Hermanos	11.45N,66.28W	Upper Cretaceous (?)	Butterlin 1956
Blanquilla	11.51N64.37W	early Eocene	Butterlin 1956
Los Testigos	11.22N.63.06W	early Eocene	Butterlin 1956

DISCUSSION

It is illogical to assume that the oldest ages determined for islands are all correct, as more recent volcanic outpourings have been obscured older, underlying plutonic and metamorphic basement rocks. Only more geologic exploration, dredging, and drilling operations will uncover the answers. Examples follow of islands where only comparatively recent ages have been determined that instead may be continental in origin. McBirney and Williams (1969) reported fossils of late Miocene age for the Galapagos Islands; Cox and Dalrymple (1966) found that K-Ar ages from whole-rock basalt samples for six of the Galapagos islands ranged from only .09 to 4.2 m.y.old. Yet Baur (1897) showed the biota to be decidedly continental. Also, giant land-tortoises occur in the Galapagos, each species restricted to a single island (Lucas 1891). Mauritius and Rodriguez are thought to be recent volcanoes of 1.6 and 8 m.y. respectively, by radiometric methods (McDougall, Upton, & Wadsworth 1965; McDougall and Chamalaun 1969). However, they possess giant land-tortoises (Lucas 1891), large flightless ground-birds, and flightless rails (Wallace 1880), evidence for a past continental contact or derivation. The last example is the Tristan da Cunha group for which Baker, Gass, Harris, and Le Maitre (1964, p. 586) reported radiometric ages (K-Ar) of only 6 ± 1.5 m.y. for Inaccessible Island and 4 m.y. for Gough Island. But an obvious archaic relict, a highly-modified flightless rail (*Atlantisia rogersi*), is restricted to Inaccessible, and an endemic land rail genus (*Porphyriornis*) occurs on Gough (Rand 1955). Thus both islands need a direct continental contact in the past to explain

this distribution. Future drilling on supposedly young volcanic islands, such as the Hawaiian Islands (McDougall 1964) and Samoan Islands (Stearns 1944) of Pliocene age, may disclose the presence of much older rocks.

Crust of continental thickness is found beneath some islands, as determined seismically and by gravity anomalies. Over much of New Zealand the crust has a typical continental thickness of 30-40 km (Thomson & Evison 1962). The Bouguer anomaly map for Viti Levu, Fiji, indicates a crust 30 km thick (Lillie and Brothers 1970). Lord Howe Rise is 29 km thick and thus is probably continental in origin (Shor, Kirk, and Menard 1971). Norfolk Ridge (22 km thick) and Campbell Plateau (average 20 km thick) are thought to probably be of continental origin (Shor, Kirk and Menard 1971; Adams 1962). Gran Canaria (15 km thick) in the Canary Islands "lies in the transition zone between oceanic and continental crust" (Bosshard and Macfarlane 1970). However, a probable high heat flow below Cyprus, the Shatsky Rise, and the Ontong Java Plateau has resulted in the up-buckling of the seafloor and a lowering of the Moho discontinuity, a process probably also taking place on Malaita in the Solomons, Macquarie Island, and elsewhere (Carey *pers. comm.*). Similarly the Agulhas Plateau, 18 km thick, is underlain by arched and faulted oceanic basement (Scrutton 1973; Emery *et al.* 1975, p.32). Thus one cannot judge continental vs. non-continental on seismic crustal thickness alone.

Clague and Dalrymple (1975) recently noted that volcanic rocks from two seamounts in the Musicians Seamounts and Necker Island, and Wentworth Seamount on the Hawaiian Ridge, showed ages at or close to their surrounding Cretaceous seafloor, indicating they formed at the crest of the East Pacific Rise. Similarly three cores from the seafloor in the Tuamotu Islands yield Eocene ages (Riedel & Funnell 1964), the same as guyots and Makatea of the Tuamotu Islands. Also, the Line Islands were 79-85 m.y. old when flow volcanism ceased on a 1270 km long segment of the chain (Schlanger 1974a, b) and may have been in contact with the South American continent at that time, since on Palmyra Atoll there is an endemic species of land-leech, an organism unlikely to be bird- or oversea-dispersed (Richardson 1975, and *in litt.*).

It is instructive to compare the oldest ages of islands with the seafloor ages of the oceans and seas containing them. In each case some of the islands predate the opening of the ocean. Thus the western Mediterranean opened in the Upper Miocene (Vogt, Higgs, & Johnson 1971), while many of the islands there are Upper Palaeozoic in age. The Scotia Sea formed in the Lower Miocene (Barker 1970), but the islands are Jurassic to Precambrian in age. The Gulf of Mexico probably formed in the Lower Cretaceous (the age of the Straits of Florida given by Wilhelm & Ewing 1972) and the Caribbean has five sites of Upper Cretaceous age from DSDP cores (Edgar *et al.* 1971), yet most of the Greater Antilles date back to the Palaeozoic. Much of the southwest Pacific formed in Lower to Upper Cretaceous times (Schlanger *et al.* 1974b; Kennett *et al.* 1973; Hayes & Ringis 1973), while continental rocks and crust are reported for many of the islands and plateaus. There is no seafloor older than the Upper Jurassic reported for the Atlantic, Indian, and Pacific Oceans (Pitman, Larson & Herron 1974; Larson 1975), yet in all three at least some of the islands and plateaus are older. The above suggests that some continental splinter fragments have been left as debris, plucked off the margins of rifting continents as ocean basins formed by seafloor spreading. In the Pacific, the distribution pattern of continental islands does not always conform to the andesite-line boundary of earlier authors.

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