

# Geography Optional – Oceanography

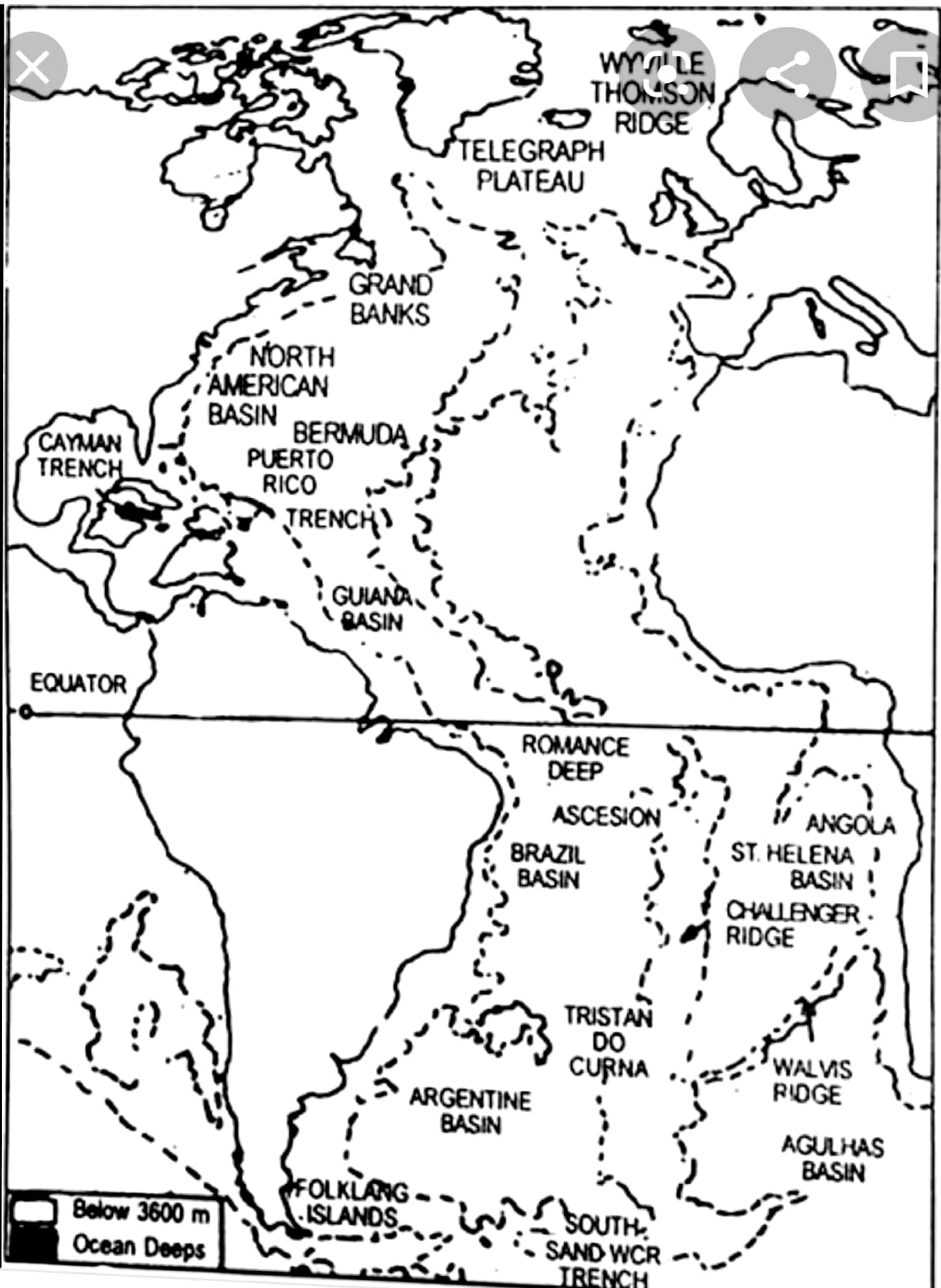
## Atlantic Ocean - Bottom

### Relief









## Bottom Topography of Atlantic Ocean.

### Atlantic Ocean:

- Located b/w: N & S America (West) and Europe & Africa (East)
- $\frac{1}{6}$ <sup>th</sup> Geographic area - Globe
- $\frac{1}{2}$  " " - Pacific.
- 2<sup>nd</sup> Largest Ocean.
- Formed: Drifting of N & S America - westward (Plate tectonics)
- Width: Northward - 4,800 Km.  
Equator ward - 2,560 Km.  
South - 5,920 Km.
- Avg. depth: Atlantic < Pacific [extensive continental shelves]

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- Widening - rate of 4cm/yr.
- Evidence: Divergence of MOR → presence of several transform faults.

## Continental Shelves

- Developed - along both coast
- Width ranges: 24 km to >80 km.
  - ↳ Largely controlled by - reliefs of coastal lands.
  - ↳ Narrow - where Mnt./hills border the coast.
    - eg. African Shelves b/w Bay of Biscay and Cape of Good Hope.
    - Brazilian Shelves b/w 5°S & 10°S latitude.
- 200-400 km wide: NE coast of N America.
  - NW " " Europe.
  - eg. Extensive Shelves - around Newfoundland (Grand Bank)
  - " " British Island (Dogges Bank)



- Marginal Seas:  
Hudson Bay  
Baltic Sea  
North Sea.

- Strait:  
Davis Strait,  
Denmark Strait.

- Enclosed Sea:  
Mediterranean Sea  
Caribbean Sea.

North Sea.

- Strait:  
Davis Strait.  
Denmark Strait.

- Enclosed Sea:  
Mediterranean Sea  
Caribbean Sea.

- Islands -

British Isles  
Iceland  
Faeroes  
West Indies  
St. Helena

Falkland  
Shetland  
Sandwich  
Cape Verde  
Trinidad

Azores  
Tristan da Cunha  
Newfoundland  
Madagascar  
South Orkneys



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Also, Coral patches  
Depositional

Mid Atlantic Ridge

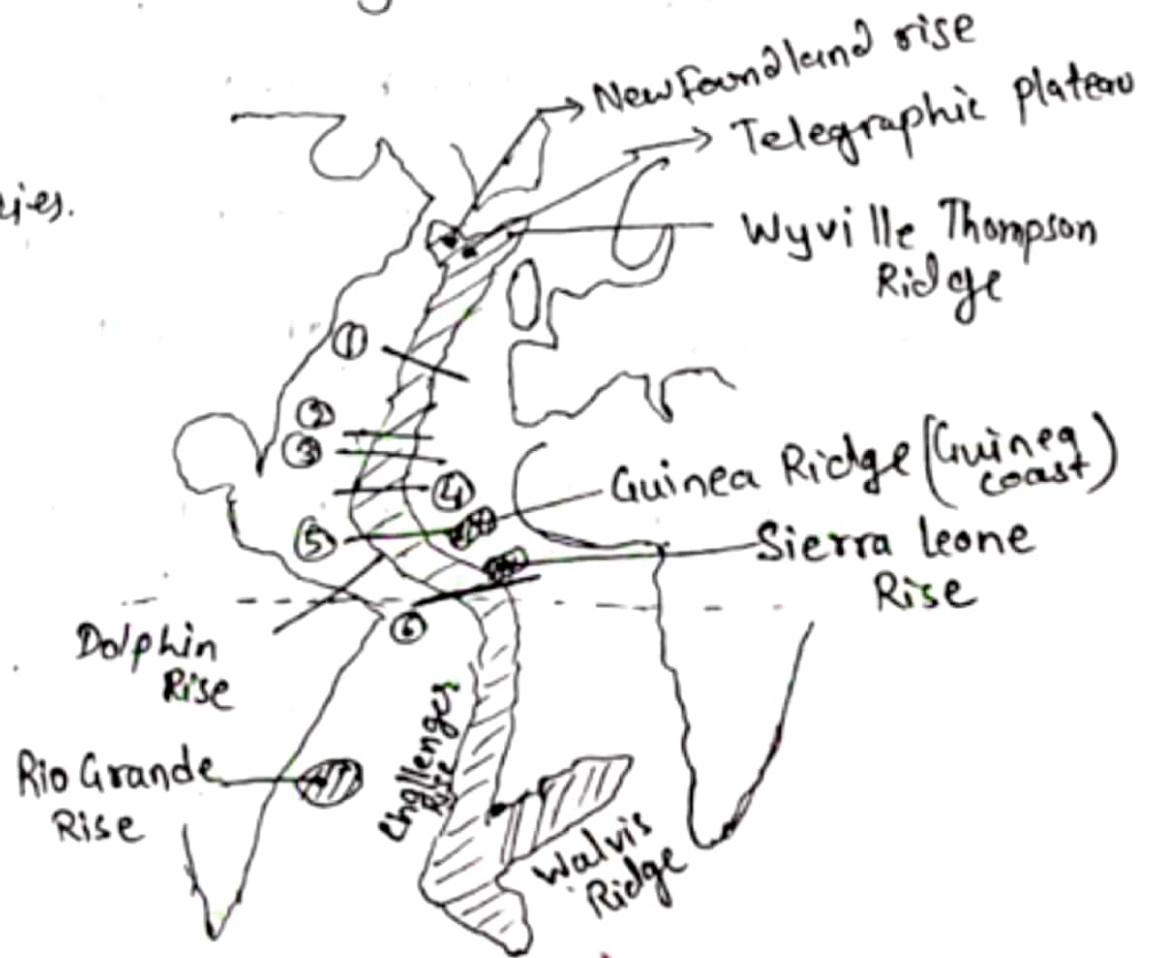
→ New Foundland rise  
→ Telegraphic plateau





## Mid Atlantic Ridge

- Zone - divergent plate boundaries.
- S Shaped (14,450 km):
  - Iceland — Bouvet Island (north)
  - (south)
- No where goes 4000 m below sea level.
- Known as:
  - Dolphin Rise (North of Eq.)
  - Challenger Rise (South of Eq.)
- B/w Iceland & Scotland:
  - Wyville Thompson Ridge
- Remains extensive - South of Greenland & Iceland



called Telegraphic Plateau  
↳ Flat cubic lid

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- Major part - Submerged under Oceanic water.
- Few peaks & sea mounts - above water surface.
  - forming islands.
- Pico Islands (Azores) - Highest peak.

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- Fractured zones:

- ① Gibbs fracture zone (Near  $40^{\circ}\text{N}$ )
- ② Oceanographic " " ( $\cdot 32^{\circ}\text{N}$ )
- ③ Atlantis " " ( $\cdot 30^{\circ}\text{N}$ )
- ④ Kane " " ( $\cdot 25^{\circ}\text{N}$ )
- ⑤ Verme " " ( $\cdot 10^{\circ}\text{N}$ )



- Mid Atlantic Ridge - divides Atlantic Ocean into 2 major Basins.

### East Atlantic Basin

#### Labrador Basin:

- B/w cont. shelf - Greenland (N)  
- Newfoundland Rise (S)
- $40^{\circ}\text{N} - 50^{\circ}\text{N}$
- Depth: 4000m - 4,500m

#### North American Basin:

- Most extensive Basin.
- $12^{\circ}\text{N} - 40^{\circ}\text{N}$
- From East coast -  $50^{\circ}\text{W}$  Meridian.
- Depth  $> 5000\text{m}$   
few place  $> 6000\text{m}$

#### Brazilian Basin:

- B/w  $0^{\circ} - 30^{\circ}\text{S}$  latitude.
- " E. coast Brazil (W) -

### West Atlantic Basin

#### Spanish Basin

- B/w - MOR & Iberian Peninsula.
- Border - Azore Rise (S) -  $50^{\circ}\text{N}$
- Avg. Depth - 5,000 m.

#### N & S Canary basin

- Almost 2 circular basins
- Depth - 5000 m

#### Cape Verde basin

- B/w MOR & W. African coast
- $10^{\circ}\text{N} - 23^{\circ}\text{N}$
- Depth - 5000 m (few  $> 5000\text{m}$ )

#### Guinea basin

- NE - SW extension
- Elongated shape.

Paradise (E)

- Depth > 4000 m.

Argentina Basin:

- 35°S - 50°S
- Depth → 5000m - 6000m

- B/w Guinea Ridge & Sierra Leone rise
- Depth: 4000m - 5000m.

Angola basin

- 0° - 30°S
- B/w African coast (NE) - knot of MOR & Walvis Ridge
- Extensive - African coast narrows down - S.W
- Depth - 5000 m.

Cape Basin : 25°S - 45°S

Agulhas Basin! 40°S - 50°S



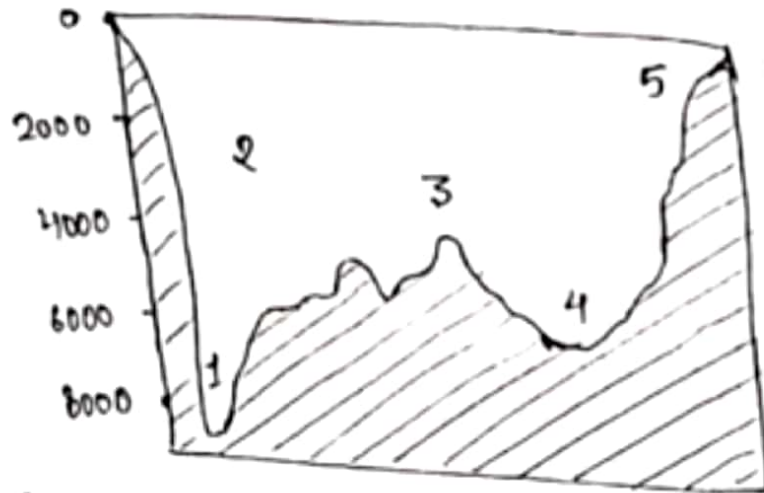


Fig: Cross Section - N. Atlantic Ocean

1. Puerto rico basin.
2. North American basin.
3. North Atlantic ridge.
4. Cape Verde basin.
5. West African Coast.

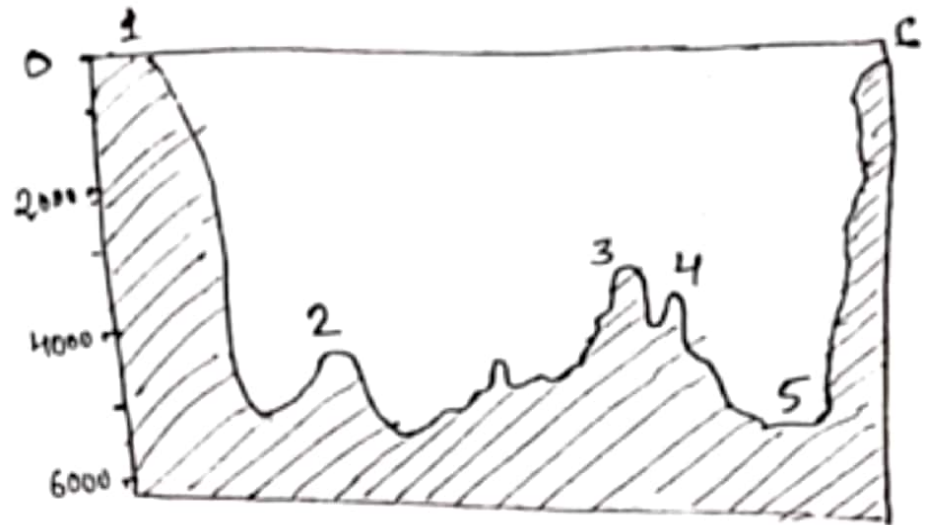


Fig: Cross Section - South Atlantic Ocean

1. East South American Coast
2. Argentina basin.
3. South Atlantic Ridge.
4. Walvis Ridge.
5. Cape basin
6. Cape Town.

## Ocean Deep

- Less compared to Pacific [absence of effects of Tertiary orogenic movements.]

1. Naues deep
2. Puerto rico deep
3. Hatteras deep.
4. Valdivia deep
5. Romanche deep
6. Buchanan deep
7. Moseley deep.
8. Vema deep

- Significant Marginal Seas
  1. Mediterranean sea.

6. Cape Town.



2. Caribbean Sea.
3. Gulf of Mexico



### Mediterranean Sea

- L Median mark of Kobes.
- L Remnant of Tethys Sea.
- L Divided into — East Basin.  
— West Basin.
- L Divided by - 4000 m deep Mid sea ridge  
( 4m S. Italian coast — North African coast )

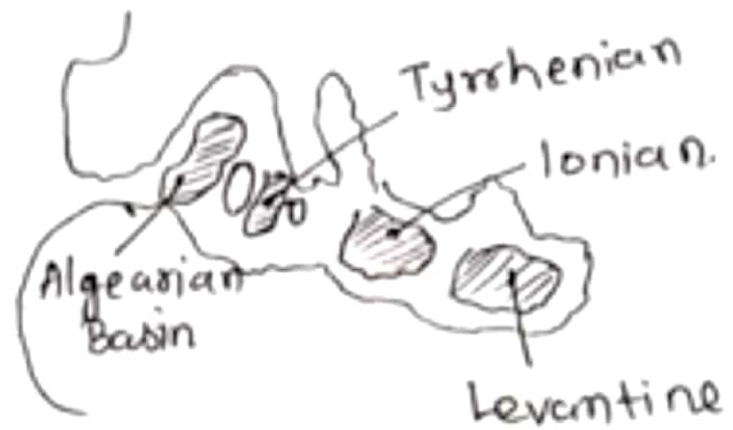
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- ↳ East basin - Ionian Basin  
- Levantine Basin.
  - ↳ West basin - Algerian Basin  
- Tyrrhenian Basin.
- Gulf of Mexico and Caribbean Sea

↳ Separated by 1,600m deep ridge  
b/w Yucatan Peninsula &  
Cuba Island.

- ↳ Caribbean Sea-divided:
- ① Yucatan basin.
  - ② Cayman trough.

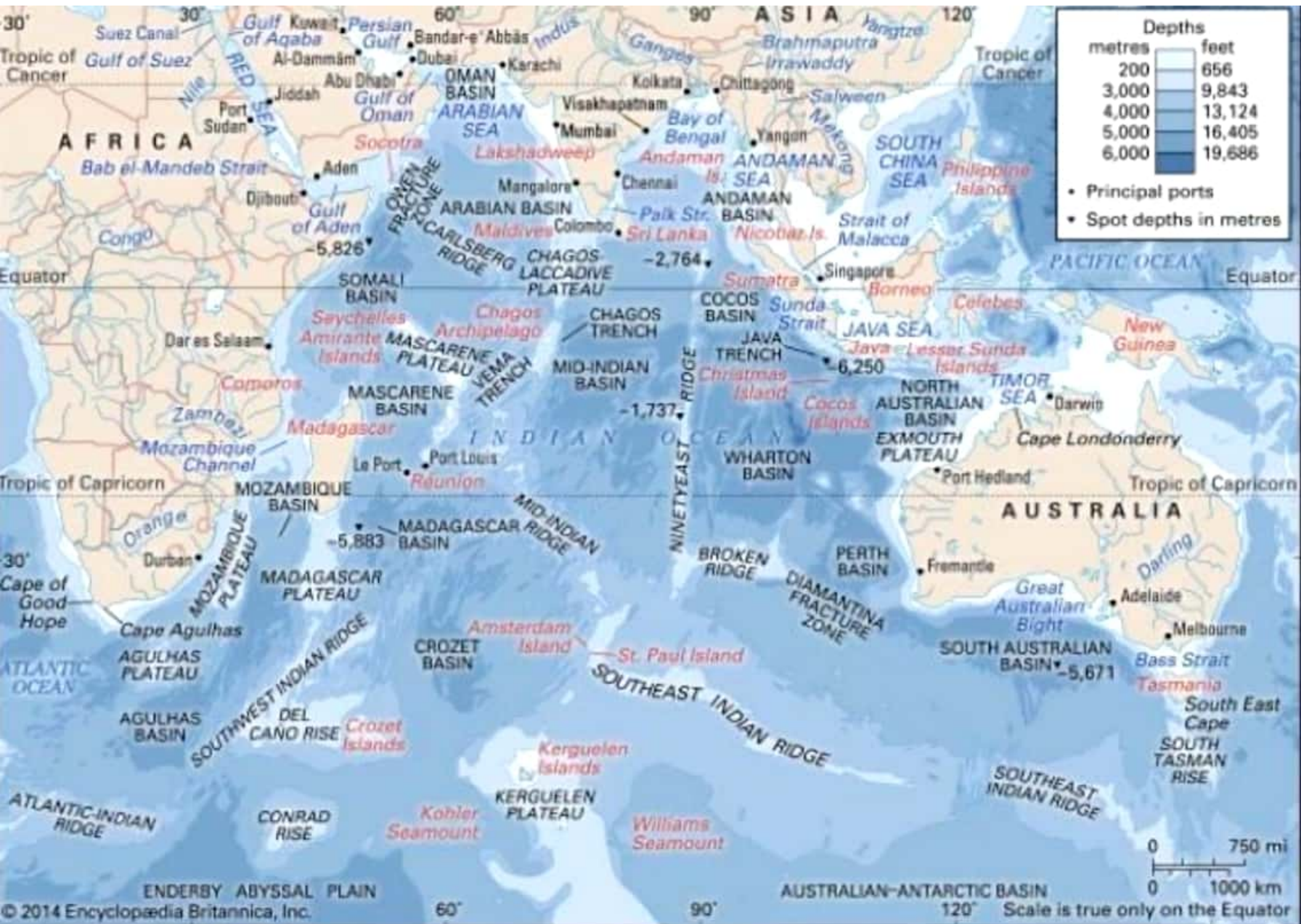




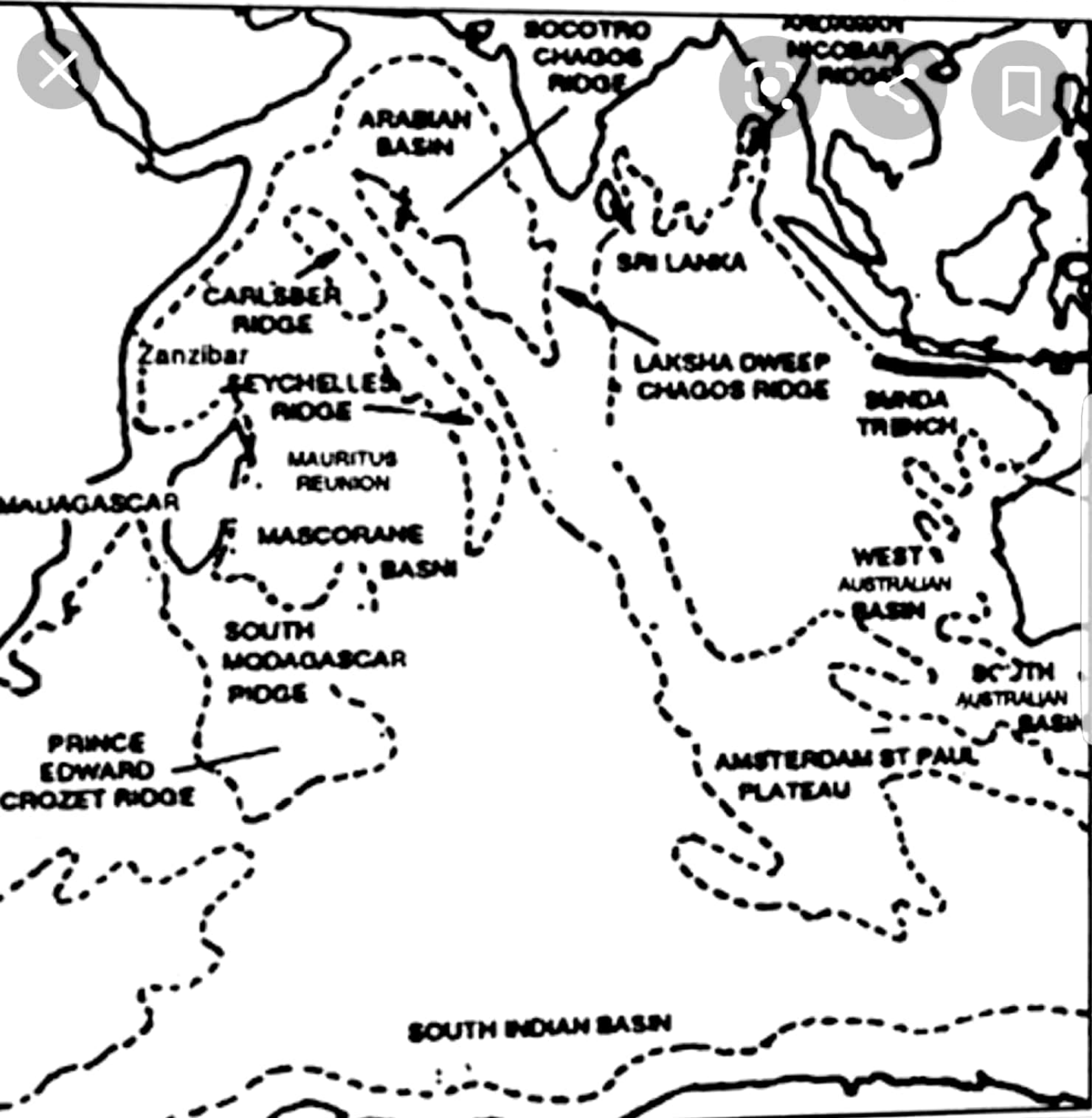
# Geography Optional – Oceanography

## Indian Ocean - Bottom

### Relief

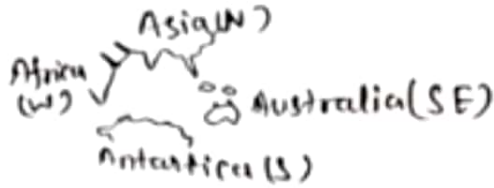






## Bottom relief - Indian Ocean.

- Smaller than Pacific and Atlantic Ocean.
- Bounded by:



- Avg. depth:

4000 m

- Major part - coastal land - Indian Ocean
  - Part of Gondwana land (Block mts.)
  - Compact and solid.
- Coast - East Indies - bordered by - fold mt. chains.
- Marginal Seas - less than Atlantic & Pacific.

Mozambique Channel

Red Sea

Persian Gulf

Andaman Sea

Bay of Bengal

Divided by  
Indian Peninsula.

Tal...



Region List

- Islands:

Big Islands

- L Madagascar.
- L Sri Lanka

Small Islands

- L Maldives
- L Seychelles
- L St. Paul

- L Lacondive
- L A7N
- L Christmas Island.

... ..

L Sri Lanka

L Seychelles  
L St. Paul

L A & N  
L Christmas Island.

- Ocean widens - South.

- Johnson - divided 3 zones:

1. Western zone (b/w Africa & Mid - Indian Ocean Ridge)

L Large no. of Islands.

L Avg. depth - 3650 m.

2. Eastern zone

L Deepest of all zones

L Avg. depth - 5,500 m.

3. Central zone

L Represents Mid-Oceanic Ridge.

L Many tiny Islands exists.

### Continental Shelf - Indian Ocean.

- wide Variation.

- Extensive Shelves;

L Along Arabian Sea and BoB.

L Along E. Coast of Africa.

L Around Madagascar (Itself located - cont. shelf)

L Very wide (~ 640 m)

- Narrow Shelves;

- ↳ Along Java and Sumatra.
- ↳ Along N. Coast of Antarctica.
- ↳ width (~160 km)
- ↳ steep Gradient.



### Mid Oceanic Ridge

- Extend:

North: S. tip - Indian Peninsula (7)

South: North of Antarctica.



Continuous chain of Islands & Highlands.

Many Island - in the course (whenever ridge emerge above sea level)



- Many Island - in the ...
- Main Central Ridge starts - Shelf of S. India. (320 km width)

• A. Laccadive - Chagos Ridge

Laka Maldive Ridge.

L Southwards - extends & widens near equator.

B. Chagos - St. Paul Ridge

L b/w  $0^{\circ}$  -  $30^{\circ}$ s

+ Avg. width - 320 km.

C. Amsterdam - St. Paul Ridge

L  $30^{\circ}$ s -  $50^{\circ}$ s

L width - 1600 km.

L Bifurcates - south of  $50^{\circ}$ s

L Kerguelen - Gaussberg ridge. (W Branch)

L Indian Antarctic ridge (E Branch)

- Branches of Central ridges;

D. Socotra - Chagos Ridge

L aka - Castlesberg Ridge.

L emerges from the central ridge @ 5°S.

L Extends N-W dir<sup>n</sup> - upto Gardafuuli peninsula of N-E Africa.

E. Seychelles - Mauritius ridge

L Bifurcate from main Ridge.

L @ 18°S - near Mauritius Island.

L Runs N-W upto Seychelles & Amirante Islands.

F. Madagascar Ridge

↳ From Southern tip of Madagascar -  $40^{\circ}$ S.

↳ Its further southward extension ( $40^{\circ}$  -  $48^{\circ}$ S)

↳ Prince Edward Crozet Ridge.

## Ocean basins

- Mid Indian Ocean Ridge - divide Indian Ocean into 2 major basins.

### Eastern Basin

#### ① Oman Basin

- ↳ Faces Gulf of Oman.
- ↳ Spread over - extensive continental shelf
- ↳ Avg depth - 3650 m.

#### ② Arabian Basin

- ↳ Almost Circular shape
- ↳ B/w Laccadive - chagos Ridge  
Socotra - chagos Ridge.
- ↳ Avg. depth - 3600m - 5480m.

#### ③ Somali Basin

### Western Basin

#### ④ Eastern Indian Antarctic Basin

- B/w: Amsterdam - St. Paul Plateau (N)  
Indian - Antarctic ridge (NE)  
Antarctica (S)  
Kerguelen - Gassberg Ridge (W)
- Depth: 3600m - 4800m.

#### ⑤ West Australian Basin

- Most extensive Basin
- Rectangular shape
- SW: SE Indian Ridge.



l Avg. depth - 3600m - 5480m.

### ⑤ Somali Basin

l B/w Socotra-Chagos ridge (N)  
Central ridge (E)  
Seychelles - Mauritius Ridges (SW)  
African continent (W)

l Avg. depth - 3,600 m.

### ④ Mauritius Basin

l 20°S - 40°S.

l B/w - Madagascar ridge (SW)  
Madagascar Island (W)  
Central ridge (E)

l Avg. depth: 3,600 - 5,500 m.

l Deepest part - 6,400 m.

- Rectangular shape

- SW: SE Indian Ridge.

- W: Ninety East Ridge

NE: Cont. Shelves Java & Sumatra

- Depth: 3600 - 6100 m.

### ⑩ Mid-Indian Basin

- W: Central ridge.

E: Ninety East Ridge

N: Bengal Plateau

- Avg. depth: 3600 - 6800 m.

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### ⑦ Atlantic-Indian-Antarctic Basin

(4) Mauritius Basin.

↳ 20°S - 40°S.

↳ B/w - Madagascar ridge (SW)  
Madagascar Island (W)  
Central ridge (E)

↳ Avg. depth: 3,600 - 5,500 m.

↳ Deepest part - 6,400 m.

(5) Mascarene Basin

↳ Oval shaped

↳ b/w Madagascar &  
Seychelles - Mauritius Ridge

(6) Agulhas Natali Basin

↳ ... very east ridge

N: Bengal Plateau

- Avg. depth: 3600 - 6800 m.

(7) Atlantic - Indian - Antarctic Basin

- Eastward continuation -  
Atlantic - Antarctic Basin.

- upto 70°E Meridian.

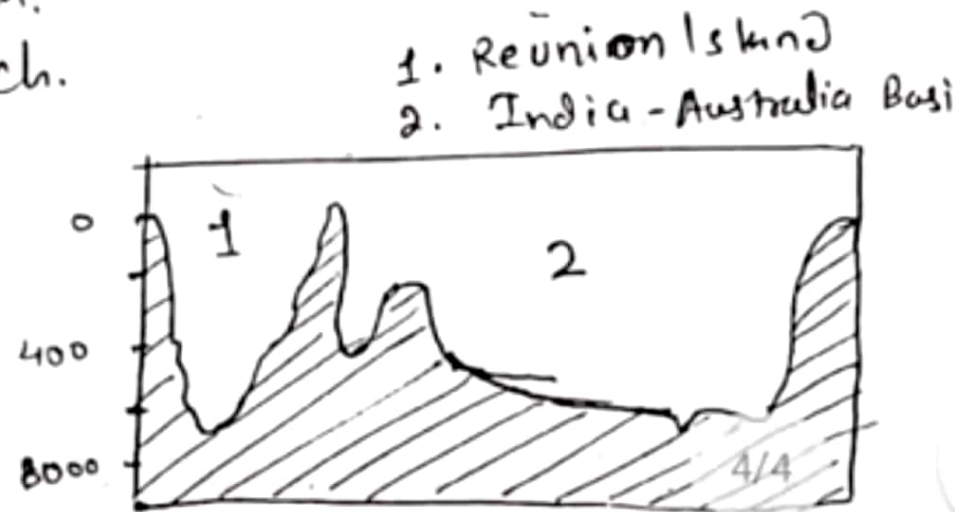
- N: Prince Edward Crozet <sup>N. 11-12</sup>  
S: Antarctica. <sub>3/4</sub>

NE: Kerguelen - Gassberg Ridge

- Avg depth - 3600m.

## Deeps and Trenches

- very few - Indian Ocean
- 60% → deep sea plains (3000 - 5500 m)
- Few Trenches: Java or Sunda Trench.  
Ob Trench.  
Mauritius Trench.  
Amirante Trench.  
Valdivia Deep.



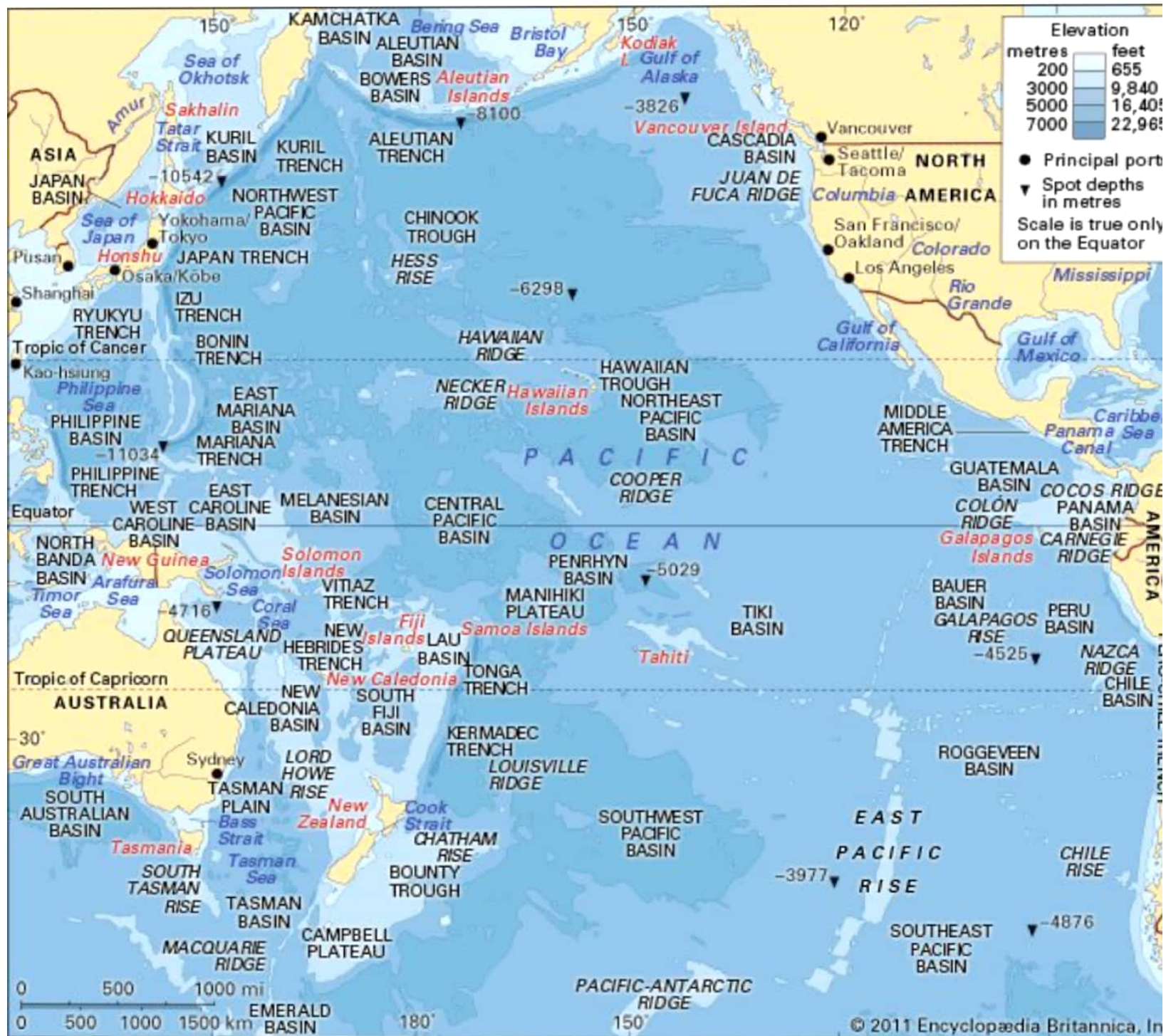
# Geography Optional – Oceanography

## Pacific Ocean - Bottom

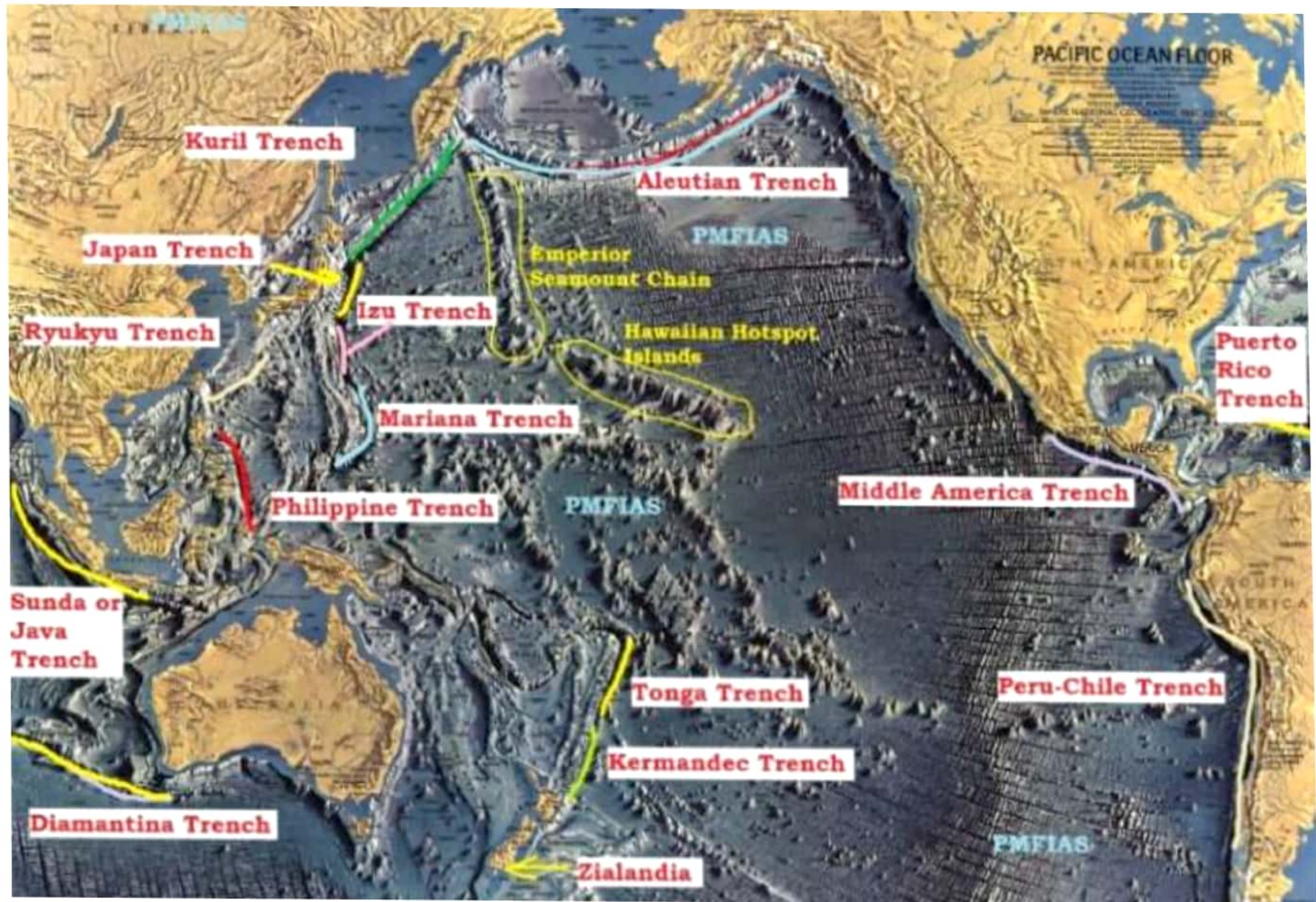
## Topography

A decorative graphic at the bottom of the page shows a white map with a green landmass and blue water. Three red pushpins are pinned to the map, one on the left, one in the middle, and one on the right.









## Pacific Ocean - Bottom Relief

+ Point Memo

- Largest Ocean
- $\frac{1}{3}^{\text{rd}}$  Globe area.
- Extension: E-W : 16,000 km [Asia (E coast) - America (W coast)]  
N-S : 14,800 km [Bering strait - Cape Andre (Antarctica)]
- Overall shape - Triangular.
- Avg. depth - 4,500 m.
- Both coast (E & W) - Parallel - Chains of folded mountain.  
∴ Descent from coast to abyssal plains - very steep.
- Largest no. of Islands (> 2000)
- Western coast - More Islands, Island arch and Festoons.



- Grouped: 3 categories:

1. Continental Islands:

Ateutian Islands

Islands of British Columbia of Canada.

Chilean Islands.



2. Island Arches & Festoons ;
- Chilean Islands.
  - Kuriles.
  - Japanese Archipelago.
  - Philippines.
  - Indonesian Islands.

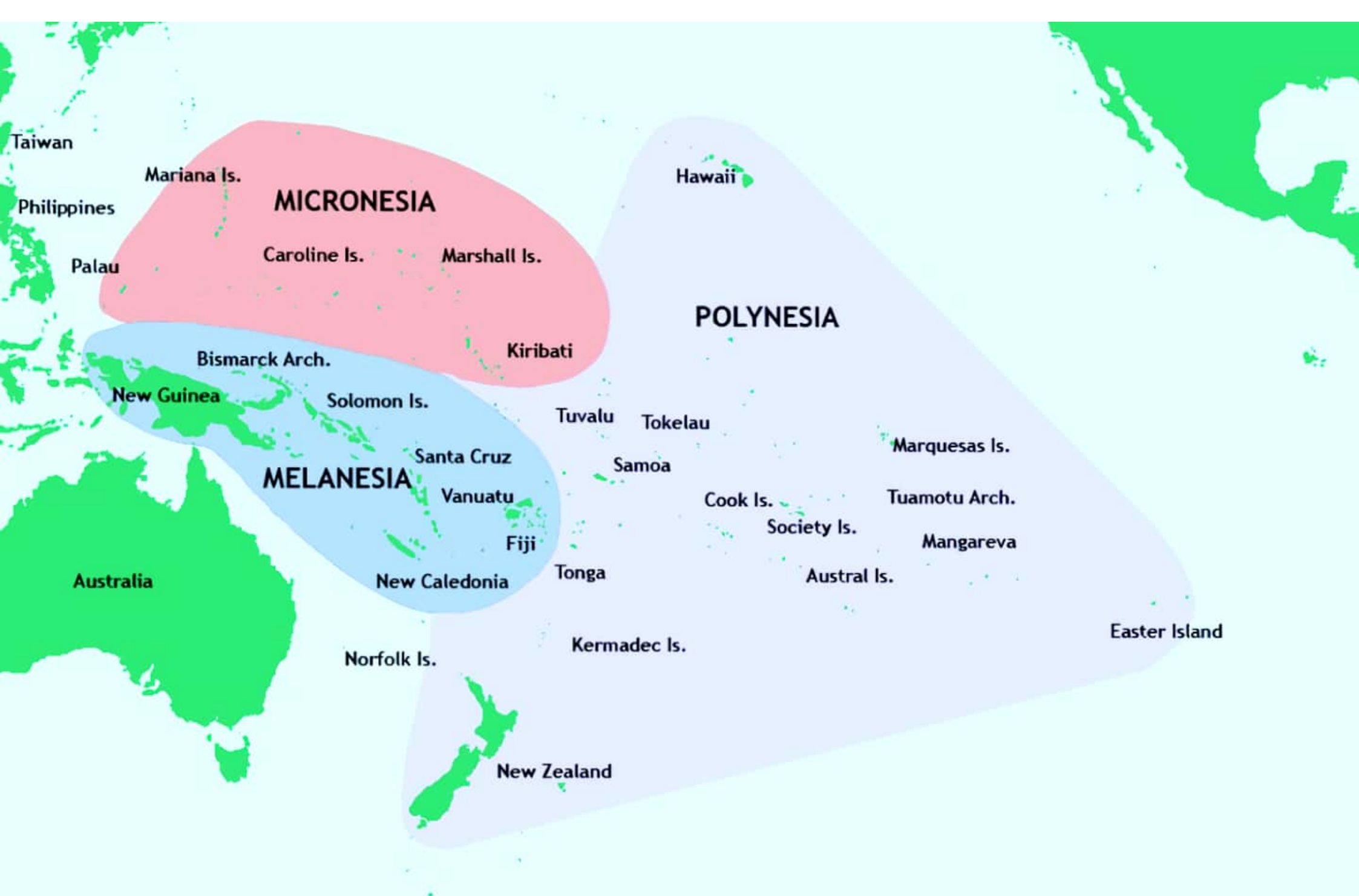
3. Scattered and Smaller Islands ;

↳ Island - Racial Groups

- Malanesia
- Micronesia
- Polynesia.

↳ Island formed - Coral reefs - Fiji, Faunafuti, Ellice

- ↳ Volcanic material - Hawaii Island.



**MICRONESIA**

**POLYNESIA**

**MELANESIA**

- Johnson divided - 4 sub regions:

1. The Northern Pacific - Deepest part of the world  
- Avg depth: 5000 m - 6000 m.

- Contact with Arctic Sea  
(through Bering Strait)

2. The Central Pacific - largest no. of Islands

↳ volcanic } origin  
↳ coral }

3. The S-W Pacific - Many Islands  
Marginal Seas

Extensive Continental Shelves

Oceanic trenches.

4. The SE Pacific - Most striking relief - East Pacific Ridge

- Absence of Marginal Seas.

## Continental Shelf

- Significant difference - extent & characteristics.
- Eastern & Western Pacific.

### - Eastern Coast

- ↳ Australia & Asia - Broad and extensive shelves.
- ↳ width varies: 160 km - 1600 km.
- ↳ Depth Ranges: 1000 m - 2000 m.
- ↳ Several Islands (on these shelves)

Kuriles

Japanese Islands.

Philippines

Indonesia

New Zealand.

↳ Numerous marginal seas (on shelves)

Bering Sea

Yellow Sea

Coral Sea

Okhotsk Sea

China Sea

Tasmania Sea

Japan Sea

Java Sea

Arafura Sea

- West Coast

↳ Less extensive shelves.

( coz. nearness - cordilleran chains of folded mountains to coastal land. )

↳ Avg. width - 80 km.



## East Pacific Rise

- No mid oceanic ridge like Atlantic or Indian Ocean.
- Few scattered ridges.

- East Pacific rise/ridge  
Laka. Albatross Plateau.

↳ 1600 km wide

↳ Extending from:  
north of New Zealand  
to the California coast.



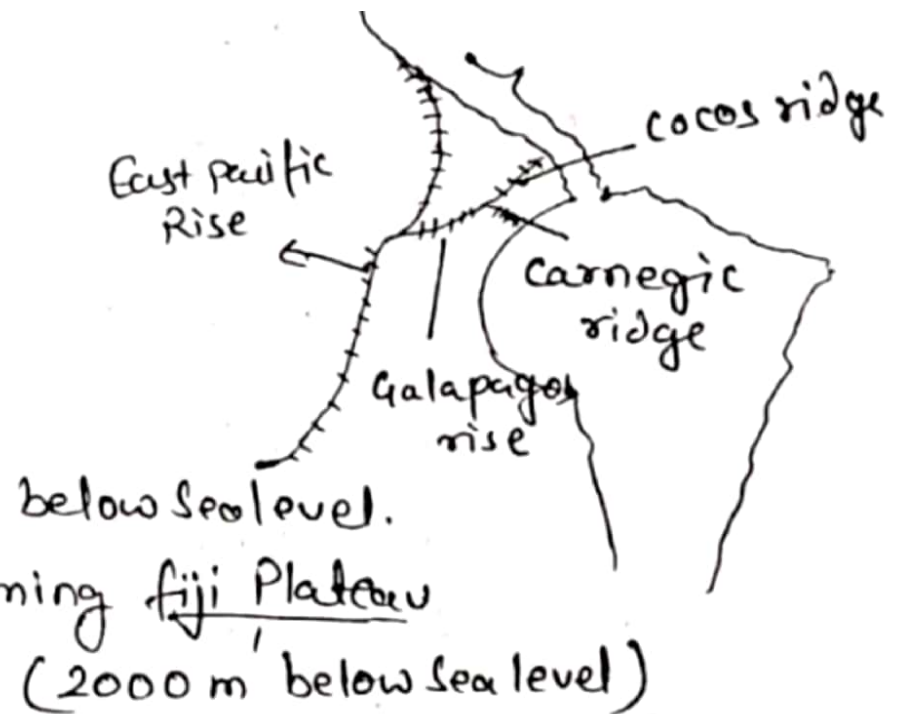
- Send off 2 branches

(b/w  $23^{\circ}\text{S}$  -  $35^{\circ}\text{S}$ )

↳ Eastern branch - Merge with Chilean Coast.

↳ Other branch - Move southward in name of East Island Rise.

- Galapagos ridge (minor ridge)
  - ↳ runs 11° - East Pacific Ridge
  - ↳ 2 branches:
    - Carnegie Ridge
    - Cocos Ridge.



- New Zealand Ridge - 200 m - 2000 m below sea level.
  - ↳ widens near Fiji Island - forming Fiji Plateau (2000 m below sea level)
- Hawaii Rise:
  - ↳ Extends N-W to S-E.
  - ↳ 960 m
  - ↳ width - 2640 km. (most extensive ridge of Pacific Ocean)

- Other minor ridges:

Nazca Ridge (off Peru coast)

Lord Howe Rise (off eastern Australian coast)

Eauripik - New Guinea Rise (North of Guinea)

- Fracture zones

1. Mendocino fracture zone.

2. Murray fracture zone.

3. Molokai " " .

4. Clarion " " .

5. Clipperton fracture zone.

6. Challenger " " .

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## Ocean Basin

### 1. Philippine Basin

- East of Philippines.
- $5^{\circ}N$  - South of Japan.
- Kyushu-Paia ridge runs - middle of basin.
- Avg. depth: 5000m - 6000m

### 2. Fiji Basin

- South of Fiji Island
- $10^{\circ}S$  -  $32^{\circ}S$
- Avg. depth: 4000m.
- North Fiji Basin  $\rightarrow 10^{\circ}S$  -  $20^{\circ}S$



SOUTH "

- Bordered by: Norfolk Island Ridge (West)  
Kermadec - Tonga Trench (East)

### 3. East Australian Basin

- B/w Australia (east coast) and New Zealand Ridge
- Avg. depth: >5000m

### 4. South Australian Basin

- Aka Jeffreys Basin
- SE of Australia
- Avg. depth: 5000m.

### 5. Peru Basin

- West of Peru Coast -  $110^{\circ}$ W.

### 7. Pacific Antarctic Basin

- S-W of Chilean Coast
- B/w  $40^{\circ}$ S and  $60^{\circ}$ S.
- Extend upto  $130^{\circ}$ W longitude

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## Ocean Deep

- Several trenches & deeps.
- Located - either along Island Arch.  
or Mountain chains.
- Mainly found in western Pacific Ocean.

- Mariana Trench

Tonga "

Kurile "

Philippine "

Japan "

Karadec "

Aleutian Trench

Ryuku "

Bonin "