



LEMURIA RESEARCH FORUM (LRF) KANYAKUMARI

**MUSLIM ARTS COLLEGE**

Thiruvithancode, Kanyakumari, Tamilnadu, India.


**THIRD INTERNATIONAL CONFERENCE**




## CERTIFICATE

This is to certify that Dr/Mr/Mrs/Ms ....C. Amose....(Had....Public).... of  
Muslim Arts College..... participated in the Third International Conference of Lemuria  
Research Forum on "REVELATIONS OF EPIGRAPHIC EXCAVATIONS" held at MUSLIM ARTS  
COLLEGE, Thiruvithancode, on 28/08/2023 and presented a paper entitled .....  
The Indian Ocean Archaeology Special Reference to First  
Settlement and African Theory of Homo Sapiens.....

  
Lion Dr. H. MOHAMED ALI  
President, LRF

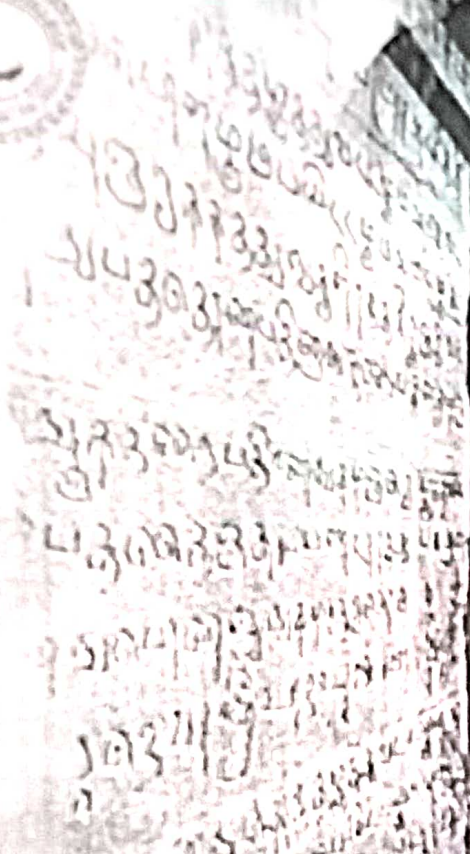
  
Dr. G. EDWIN SHEELA  
Principal, MAC

  
Dr. C. AMOSE  
Secretary, LRF

ISBN : 978-81-908060-0-8

PROCEEDINGS OF THE LEMURIA RESEARCH FORUM,

KANYAKUMARI



28/08/2023

THIRD

INTERNATIONAL

CONFERENCE OF

LEAF -2023

# REVELATIONS OF EPIGRAPHIC EXCAVATIONS



கல்வெட்டு அகழ்வாராய்ச்சிகளின்  
வெளிப்பாடுகள்

ISBN 978-81-908060-0-8

**PROCEEDINGS OF THE LEMURIA RESEARCH FORUM  
KANYAKUMARI  
MUSLIM ARTS COLLEGE, THIRUVITHANCODE**

**Conference Proceedings  
(Multi disciplinary)**



**THIRD INTERNATIONAL CONFERENCE OF LRF-  
2023**

**Theme : REVELATIONS OF EPIGRAPHIC EXCAVATIONS**

கல்வெட்டு அகழ்வாராய்ச்சிகளின் வெளிப்பாடுகள்

Date : 28-08-2023



**LEMURIA RESEARCH FORUM - KANYAKUMARI  
MUSLIM ARTS COLLEGE, THIRUVITHANCODE**

**Pin - 629174, Tamil Nadu, India**



ISBN 978-81-908060-0-8



## CONTENT

TITLE	PAGE NO
THE INDIAN OCEAN ARCHAEOLOGY SPECIAL REFERENCE TO FIRST SETTLEMENT AND AFRICAN THEORY OF HOMO SAPIENS <i>Dr.C.Amose</i>	1
HISTORICAL REVIEW OF A MYSTERIOUS SOUTH ASIAN QUEEN <i>Shojin. S., Dr. Raichel C Raj</i>	10
A STUDY ON COMMERCIAL GUILD INSCRIPTION NEAR KARUR <i>Dr. D. Selvakumar..</i>	13
ETHNOBOTANICAL SURVEY OF EDIBLE FRUITS CONSUMED BY PEOPLE AROUND NAGERCOIL, KANNYAKUMARI DISTRICT <i>Nikitha Jose, Jenil Prabha. K, Iren Amutha. A</i>	19
CIVILIZATION OF THE EASTERN PART OF THE CRESCENT <i>Dr. C. Nirmala Devi</i>	29
RECENT ARCHAEOLOGICAL DISCOVERIES IN TAMIL NADU: A CASE STUDY <i>Dr. S. Eazhil Stephy</i>	36
THE REFLECTION AND TYPES OF INDIAN INSCRIPTIONS <i>Er.A.Bessy Beryl, Dr.C.Amose</i>	41
ORIGIN OF PADMANABHAPURAM <i>M.Asarudheen</i>	44
ARCHITECTURAL HERITAGE OF THE GULF, DUBAI - A STUDY <i>Jenisha J. Hannah</i>	46
COMPREHENSIVE VIEW AND ITS IMPACT OF BIOPOLYMER <i>M.Jude Jenita</i>	51
BELIEFS AND CUSTOMS OF THE COASTAL PEOPLE OF KANYAKUMARI DISTRICT <i>T. Brigit Hema</i>	56
CYCLODEXTRIN BASED HOST-GUEST COMPLEXES - A REVIEW <i>DR. R. Periasamy</i>	59
ESTIMATION OF ANTIOXIDANT ACTIVITY IN <i>COSTUS IGNEUS</i> LEAF EXTRACTS BY USING PHOSPHOMOLYBDENUM ASSAY <i>Benila S And R. Ragel Mabel Saroja</i>	63
SELF-ACTUALIZATION OF SARIṬA IN SHASHI DESHPANDE'S <i>THE DARK HOLDS NO TERRORS</i> <i>Dr. Raeshma Godsen</i>	67
MODERN AND POST MODERN ATTITUDE OF PREETI SHENOY'S <i>A HUNDRED LITTLE FLAMES</i> <i>T.S.Sreekala, Dr.J.Jesu Latha</i>	71
INVITRO ANTIOXIDANT ACTIVITY OF <i>ANNONA MURICATA</i> L. FRUIT USING VARIOUS SOLVENT EXTRACTS. <i>Jerin Asha T<sup>1</sup>, Medo Merina R<sup>2</sup> and Bojaxa A Rosy<sup>3</sup></i>	75
"THE CONTRIBUTIONS OF TELUGU RULERS TO TAMIL COUNTRY WITH SPECIAL REFERENCE TO MADURAI NAYAKS (from 1529 to 1736 A.D.)- A STUDY" <i>Dr. A. Jeseentha Mary</i>	80

# THE INDIAN OCEAN ARCHAEOLOGY SPECIAL REFERENCE TO FIRST SETTLEMENT AND AFRICAN THEORY OF HOMO SAPIENS

Dr.C.AMOSE

Associate Professor of History  
HOD, Department of Public Administration  
Muslim Arts College, Thiruvithancode.

## Abstract

*The Indian Ocean is the third largest of the world five Oceanic divisions. Chinese explores called as western Oceans. The largest rivers which drain in the Indian Ocean are Zambezi Ganges, Bhahmaputra, Indus, Julba and Murruy rivers. The Mozambique channel separation madagascar from maintained Africa. The climate north of the equator is affected by a monsoon climate. Forty percent of the sediment of the Indian Ocean is found in the Indus and Ganges fans. Research indicates that increasing ocean temperatures are taking a toll on the marine ecosystem of Earth's 36 biodiversity hotspot nine are located on the margins of the Indian Ocean. A series of ridges and sea mount chains produced by hotspots pass over the Indian Ocean. Africa theory states the Homo Sapiens spread from Africa into mainland Eurasia. The history of the Indian Ocean is marked by maritime trade. During the 1st and 2<sup>nd</sup> centuries AD intensive trade relations developed. Between Roman, Egypt and Tamil Kingdoms.*

*The Indian Ocean is the third-largest of the world's five oceanic divisions, covering 19.8% of the water on Earth's surface. It is bounded by Asia to the north, Africa to the west and Australia to the east. To the south it is bounded by the Southern Ocean or Antarctica depending on the definition in use. Along its core, the Indian Ocean has some large marginal or regional seas such as the Arabian Sea, Laccadive Sea, Bay of Bengal and Andaman Sea. The Indian Ocean has been known by its present name since at least 1515 when the Latin form Oceanus Orientalis Indicus is attested, named after India, which projects into it. It was earlier known as the Eastern Ocean, a term that was still in use during the mid-18th century as opposed to the Western Ocean (Atlantic) before the Pacific was surmised. Conversely, Chinese explorers who traveled to the Indian Ocean during the 15th century called it the Western Oceans. In Ancient Greek geography, the Indian Ocean region known to the Greeks was called the Erythraean Sea.*

## Extent and data of the Ocean

The borders of the Indian Ocean, as delineated by the International Hydrographic Organization in 1953 included the Southern Ocean but not the marginal seas along the northern rim but in 2002 the IHO delimited the Southern Ocean separately, which removed waters south of 60°S from the Indian Ocean but included the northern marginal seas. Meridionally, the Indian Ocean is delimited from the Atlantic Ocean by the 20° east meridian, running south from Cape Agulhas, South Africa, and from the Pacific Ocean by the meridian of 146°49'E, running south from South East Cape on the island of Tasmania in Australia. The northernmost extent of the Indian Ocean (including

marginal seas) is approximately 30° north in the Persian Gulf.

It has an average depth of 3,741 m (12,274 ft) and a maximum depth of 7,906 m (25,938 ft). All of the Indian Ocean is in the Eastern Hemisphere and the centre of the Eastern Hemisphere, the 90th meridian east, passes through the Ninety East Ridge.

## Coasts and shelves

In contrast to the Atlantic and Pacific, the Indian Ocean is enclosed by major landmasses and an archipelago on three sides and does not stretch from pole to pole, and can be likened to an embayed ocean. It is centered on the Indian Peninsula. Although this subcontinent has played a significant role in its history, the

Indian Ocean has foremostly been a cosmopolitan stage, interlinking diverse regions by innovations, trade, and religion since early in human history. Australia, Indonesia, and India are the three countries with the longest shorelines and exclusive economic zones. The continental shelf makes up 15% of the Indian Ocean. More than two billion people live in countries bordering the Indian Ocean, compared to 1.7 billion for the Atlantic and 2.7 billion for the Pacific.

#### Rivers drain in the Ocean

The Indian Ocean drainage basin covers 21,100,000 km<sup>2</sup>, virtually identical to that of the Pacific Ocean and half that of the Atlantic basin, or 30% of its ocean surface. The Indian Ocean drainage basin is divided into roughly 800 individual basins, half that of the Pacific, of which 50% are located in Asia, 30% in Africa, and 20% in Australasia. The rivers of the Indian Ocean are shorter on average than those of the other major oceans. The largest rivers are the Zambezi, Ganges-Brahmaputra, Indus, Jubba, and Murray rivers and the Shatt al-Arab, Wadi Ad Dawasir and Limpopo rivers. After the breakup of East Gondwana and the formation of the Himalayas, the Ganges-Brahmaputra rivers flow into the world's largest delta known as the Bengal delta or Sunderbans.

#### Marginal seas

Along the east coast of Africa, the Mozambique Channel separates Madagascar from mainland Africa, while the Sea of Zanj is located north of Madagascar. On the northern coast of the Arabian Sea, Gulf of Aden is connected to the Red Sea by the strait of Bab-el-Mandeb. In the Gulf of Aden, the Gulf of Tadjoura is located in Djibouti and the Guardafui Channel separates Socotra island from the Horn of Africa. The northern end of the Red Sea terminates in the Gulf of Aqaba and Gulf of Suez. The Indian Ocean is artificially connected to the Mediterranean Sea without ship lock through the Suez Canal, which is accessible via the Red Sea. The Arabian Sea is

connected to the Persian Gulf by the Gulf of Oman and the Strait of Hormuz. In the Persian Gulf, the Gulf of Bahrain separates Qatar from the Arabic Peninsula.

Along the west coast of India, the Gulf of Kutch and Gulf of Khambat are located in Gujarat in the northern end while the Laccadive Sea separates the Maldives from the southern tip of India. The Bay of Bengal is off the east coast of India. The Gulf of Mannar and the Palk Strait separates Sri Lanka from India, while the Adam's Bridge separates the two. The Andaman Sea is located between the Bay of Bengal and the Andaman Islands. In Indonesia, the so-called Indonesian Seaway is composed of the Malacca, Sunda and Torres Straits. The Gulf of Carpentaria is located on the Australian north coast while the Great Australian Bight constitutes a large part of its southern coast.

#### Climate in the Ocean

Several features make the Indian Ocean unique. It constitutes the core of the large-scale Tropical Warm Pool which, when interacting with the atmosphere, affects the climate both regionally and globally. Asia blocks heat export and prevents the ventilation of the Indian Ocean thermocline. That continent also drives the Indian Ocean monsoon, the strongest on Earth, which causes large-scale seasonal variations in ocean currents, including the reversal of the Somali Current and Indian Monsoon Current. Because of the Indian Ocean Walker circulation there are no continuous equatorial easterlies. Upwelling occurs near the Horn of Africa and the Arabian Peninsula in the Northern Hemisphere and north of the trade winds in the Southern Hemisphere. The Indonesian Throughflow is a unique Equatorial connection to the Pacific.

The climate north of the equator is affected by a monsoon climate. Strong north-east winds blow from October until April; from May until October south and west winds prevail. In the Arabian Sea, the

Violent Monsoon brings rain to the Indian subcontinent. In the southern hemisphere, the winds are generally milder, but summer storms near Mauritius can be severe. When the monsoon winds change, cyclones sometimes strike the shores of the Arabian Sea and the Bay of Bengal. Some 80% of the total annual rainfall in India occurs during summer and the region is so dependent on this rainfall that many civilisations perished when the Monsoon failed in the past. The huge variability in the Indian Summer Monsoon has also occurred pre-historically, with a strong, wet phase 33,500–32,500 BP; a weak, dry phase 26,000–23,500 BC; and a very weak phase 17,000–15,000 BP, corresponding to a series of dramatic global events: Bølling-Allerød, Heinrich, and Younger Dryas.

South of the Equator (20–5°S), the Indian Ocean is gaining heat from June to October, during the austral winter, while it is losing heat from November to March, during the austral summer. In 1999, the Indian Ocean Experiment showed that fossil fuel and biomass burning in South and Southeast Asia caused air pollution (also known as the Asian brown cloud) that reach as far as the Intertropical Convergence Zone. This pollution has implications on both a local and global scale.

### Oceanography

Forty percent of the sediment of the Indian Ocean is found in the Indus and Ganges fans. The oceanic basins adjacent to the continental slopes mostly contain terrigenous sediments. The ocean south of the polar front (roughly 50° south latitude) is high in biologic productivity and dominated by non-stratified sediment composed mostly of siliceous oozes. Near the three major mid-ocean ridges the ocean floor is relatively young and therefore bare of sediment, except for the Southwest Indian Ridge due to its ultra-slow spreading rate. The ocean's currents are mainly controlled by the monsoon. Two large gyres, one in the northern hemisphere flowing clockwise and one south of the equator moving anticlockwise (including

the Agulhas Current and Agulhas Return Current), constitute the dominant flow pattern. During the winter monsoon (November–February), however, circulation is reversed north of 30°S and winds are weakened during winter and the transitional periods between the monsoons.

The Indian Ocean contains the largest submarine fans of the world, the Bengal Fan and Indus Fan, and the largest areas of slope terraces and rift valleys. The inflow of deep water into the Indian Ocean is 11 Sv, most of which comes from the Circumpolar Deep Water (CDW). The CDW enters the Indian Ocean through the Crozet and Madagascar basins and crosses the Southwest Indian Ridge at 30°S. In the Mascarene Basin the CDW becomes a deep western boundary current before it is met by a re-circulated branch of itself, the North Indian Deep Water. This mixed water partly flows north into the Somali Basin whilst most of it flows clockwise in the Mascarene Basin where an oscillating flow is produced by Rossby waves.

### Water Circulation

Water circulation in the Indian Ocean is dominated by the Subtropical Anticyclonic Gyre, the eastern extension of which is blocked by the Southeast Indian Ridge and the 90°E Ridge. Madagascar and the Southwest Indian Ridge separate three cells south of Madagascar and off South Africa. North Atlantic Deep Water reaches into the Indian Ocean south of Africa at a depth of 2,000–3,000 m and flows north along the eastern continental slope of Africa. Deeper than NADW, Antarctic Bottom Water flows from Enderby Basin to Agulhas Basin across deep channels (<4,000 m (13,000 ft)) in the Southwest Indian Ridge, from where it continues into the Mozambique Channel and Prince Edward Fracture Zone.

The Bay of Bengal contributes more than half (2,950 km) of the runoff water to the Indian Ocean. Mainly in summer, this runoff flows into the Arabian Sea but also south across the Equator where it mixes with fresher seawater from the Indonesian

Throughflow. This mixed freshwater joins the South Equatorial Current in the southern tropical Indian Ocean. Sea surface salinity is highest (more than 36 PSU) in the Arabian Sea because evaporation exceeds precipitation there. In the Southeast Arabian Sea salinity drops to less than 34 PSU. It is the lowest (c. 33 PSU) in the Bay of Bengal because of river runoff and precipitation. The Indonesian Throughflow and precipitation results in lower salinity (34 PSU) along the Sumatran west coast. Monsoonal variation results in eastward transportation of saltier water from the Arabian Sea to the Bay of Bengal from June to September and in westerly transport by the East India Coastal Current to the Arabian Sea from January to April. It is found that Arabian Sea warming is in response to the reduction in lower monsoon circulation in recent decades.

#### **Garbage in the Ocean**

An Indian Ocean garbage patch was discovered in 2010 covering at least 5 million square kilometres (1.9 million square miles). Riding the southern Indian Ocean Gyre, this vortex of plastic garbage constantly circulates the ocean from Australia to Africa, down the Mozambique Channel, and back to Australia in a period of six years, except for debris that gets indefinitely stuck in the centre of the gyre. The garbage patch in the Indian Ocean will, according to a 2012 study, decrease in size after several decades to vanish completely over centuries. Over several millennia, however, the global system of garbage patches will accumulate in the North Pacific. There are two amphidromes of opposite rotation in the Indian Ocean, probably caused by Rossby wave propagation. Icebergs drift as far north as 55° south latitude, similar to the Pacific but less than in the Atlantic where icebergs reach up to 45°S. The volume of iceberg loss in the Indian Ocean between 2004 and 2012 was 24 Gt. Since the 1960s, anthropogenic warming of the global ocean combined with contributions of freshwater from retreating land ice causes a

global rise in sea level. Sea level also increases in the Indian Ocean, except in the south tropical Indian Ocean where it decreases, a pattern most likely caused by rising levels of greenhouse gases.

#### **Marine life in the Ocean**

Among the tropical oceans, the western Indian Ocean hosts one of the largest concentrations of phytoplankton blooms in summer, due to the strong monsoon winds. The monsoonal wind forcing leads to a strong coastal and open ocean upwelling, which introduces nutrients into the upper zones where sufficient light is available for photosynthesis and phytoplankton production. These phytoplankton blooms support the marine ecosystem, as the base of the marine food web, and eventually the larger fish species. The Indian Ocean accounts for the second-largest share of the most economically valuable tuna catch. Its fish are of great and growing importance to the bordering countries for domestic consumption and export. Fishing fleets from Russia, Japan, South Korea, and Taiwan also exploit the Indian Ocean, mainly for shrimp and tuna.

Research indicates that increasing ocean temperatures are taking a toll on the marine ecosystem. A study on the phytoplankton changes in the Indian Ocean indicates a decline of up to 20% in the marine plankton in the Indian Ocean, during the past six decades. The tuna catch rates have also declined 50–90% during the past half-century, mostly due to increased industrial fisheries, with the ocean warming adding further stress to the fish species.

#### **Productive ecosystem**

Coral reefs, sea grass beds, and mangrove forests are the most productive ecosystems of the Indian Ocean — coastal areas produce 20 tones of fish per square kilometre. These areas, however, are also being urbanised with populations often exceeding several thousand people per square kilometre and fishing techniques become more effective and often destructive beyond sustainable levels while the increase

a sea surface temperature spreads coral bleaching.

Mangroves covers 80,984 km<sup>2</sup> (31,268 sq mi) in the Indian Ocean region, or almost half of the world's mangrove habitat, of which 42,500 km<sup>2</sup> is located in Indonesia, or 50% of mangroves in the Indian Ocean. Mangroves originated in the Indian Ocean region and have adapted to a wide range of its habitats but it is also where it suffers its biggest loss of habitat.

### **Animal species**

In 2016, six new animal species were identified at hydrothermal vents in the Southwest Indian Ridge: a "Hoff" crab, a "giant peltospirid" snail, a whelk-like snail, a limpet, a scaleworm and a polychaete worm. The West Indian Ocean coelacanth was discovered in the Indian Ocean off South Africa in the 1930s and in the late 1990s another species, the Indonesian coelacanth, was discovered off Sulawesi Island, Indonesia. Most extant coelacanths have been found in the Comoros. Although both species represent an order of lobe-finned fishes known from the Early Devonian (410 mya) and though extinct 66 mya, they are morphologically distinct from their Devonian ancestors. Over millions of years, coelacanths evolved to inhabit different environments — lungs adapted for shallow, brackish waters evolved into gills adapted for deep marine waters.

### **Biodiversity in the Ocean**

Of Earth's 36 biodiversity hotspot nine are located on the margins of the Indian Ocean. Madagascar and the islands of the western Indian Ocean (Comoros, Réunion, Mauritius, Rodrigues, the Seychelles, and Socotra), includes 13,000 species of plants; 313 birds; reptiles 381; 164 freshwater fishes; 250 amphibians; and 200 mammals. The origin of this diversity is debated; the break-up of Gondwana can explain vicariance older than 100 mya, but the diversity on the younger, smaller islands must have required a Cenozoic dispersal from the rims of the Indian Ocean to the islands. A "reverse colonisation", from islands to continents, apparently occurred

more recently; the chameleons, for example, first diversified on Madagascar and then colonised Africa. Several species on the islands of the Indian Ocean are textbook cases of evolutionary processes; the dung beetles, day geckos, and lemurs are all examples of adaptive radiation. Many bones of recently extinct vertebrates have been found in the Mare aux Songes swamp in Mauritius, including bones of the Dodo bird and *Cylindraspis* giant tortoise. An analysis of these remains suggests a process of aridification began in the southwest Indian Ocean began around 4,000 years ago. This biodiversity hotspot is a patchwork of small forested areas, often with a unique assemblage of species within each, located within 200 km (120 mi) from the coast and covering a total area of c. 6,200 km<sup>2</sup>. It also encompasses coastal islands, including Zanzibar and Pemba, and Mafia.

This area, one of the only two hotspots that are entirely arid, includes the Ethiopian Highlands, the East African Rift valley, the Socotra islands, as well as some small islands in the Red Sea and areas on the southern Arabic Peninsula. Endemic and threatened mammals include the dibatag and Speke's gazelle; the Somali wild ass and hamadryas baboon. It also contains many reptiles. In Somalia, the centre of the 1,500,000 km<sup>2</sup> hotspot, the landscape is dominated by *Acacia-Commiphora* deciduous bushland, but also includes the Yeheb nut and species discovered more recently such as the Somali cyclamen, the only cyclamen outside the Mediterranean. Warsangli linnet is an endemic bird found only in northern Somalia. An unstable political situation and mismanagement has resulted in overgrazing which has produced one of the most degraded hotspots where only c. 5 % of the original habitat remains.

### **Indo-Srilanka and Indo-Burma**

Encompassing the west coast of India and Sri Lanka, until c. 10,000 years ago a landbridge connected Sri Lanka to the Indian Subcontinent, hence this region shares a common community of species.

Indo-Burma encompasses a series of mountain ranges, five of Asia's largest river systems, and a wide range of habitats. The region has a long and complex geological history, and long periods rising sea levels and glaciations have isolated ecosystems and thus promoted a high degree of endemism and speciation. The region includes two centres of endemism: the Annamite Mountains and the northern highlands on the China-Vietnam border. Several distinct floristic regions, the Indian, Malesian, Sino-Himalayan, and Indochinese regions, meet in a unique way in Indo-Burma and the hotspot contains an estimated 15,000–25,000 species of vascular plants, many of them endemic.

### Islands in the Ocean

Sundaland encompasses 17,000 islands of which Borneo and Sumatra are the largest. Endangered mammals include the Bornean and Sumatran orangutans, the proboscis monkey, and the Javan and Sumatran rhinoceroses. Stretching from Shark Bay to Israelite Bay and isolated by the arid Nullarbor Plain, the southwestern corner of Australia is a floristic region with a stable climate in which one of the world's largest floral biodiversity and an 80% endemism has evolved. From June to September it is an explosion of colours and the Wildflower Festival in Perth in September attracts more than half a million visitors.

### Geology of Indian Ocean

As the youngest of the major oceans, the Indian Ocean has active spreading ridges that are part of the worldwide system of mid-ocean ridges. In the Indian Ocean these spreading ridges meet at the Rodrigues Triple Point with the Central Indian Ridge, including the Carlsberg Ridge, separating the African Plate from the Indian Plate; the Southwest Indian Ridge separating the African Plate from the Antarctic Plate; and the Southeast Indian Ridge separating the Australian Plate from the Antarctic Plate. The Central Indian Ridge is intercepted by the Owen Fracture Zone. Since the late 1990s,

however, it has become clear that this traditional definition of the Indo-Australian Plate cannot be correct; it consists of three plates — the Indian Plate, the Capricorn Plate, and Australian Plate — separated by diffuse boundary zones. Since 20 Ma the African Plate is being divided by the East African Rift System into the Nubian and Somalia plates. There are only two trenches in the Indian Ocean: the 6,000 km long Java Trench between Java and the Sunda Trench and the 900 km long Makran Trench south of Iran and Pakistan.

A series of ridges and seamount chains produced by hotspots pass over the Indian Ocean. The Réunion hotspot (active 70–40 million years ago) connects Réunion and the Mascarene Plateau to the Chagos-Laccadive Ridge and the Deccan Traps in north-western India; the Kerguelen hotspot (100–35 million years ago) connects the Kerguelen Islands and Kerguelen Plateau to the Ninety East Ridge and the Rajmahal Traps in north-eastern India; the Marion hotspot (100–70 million years ago) possibly connects Prince Edward Islands to the Eighty Five East Ridge. These hotspot tracks have been broken by the still active spreading ridges mentioned above.

### Seamounts in the Ocean

There are fewer seamounts in the Indian Ocean than in the Atlantic and Pacific. These are typically deeper than 3,000 m (9,800 ft) and located north of 55°S and west of 80°E. Most originated at spreading ridges but some are now located in basins far away from these ridges. The ridges of the Indian Ocean form ranges of seamounts, sometimes very long, including the Carlsberg Ridge, Madagascar Ridge, Central Indian Ridge, Southwest Indian Ridge, Chagos-Laccadive Ridge, 85°E Ridge, 90°E Ridge, Southeast Indian Ridge, Broken Ridge, and East Indian Ridge. The Agulhas Plateau and Mascarene Plateau are the two major shallow areas. The opening of the Indian Ocean began c. 156 Ma when Africa

separated from East Gondwana. The Indian Subcontinent began to separate from Australia-Antarctica 135–125 Ma and as the Tethys Ocean north of India began to close 118–84 Ma the Indian Ocean opened behind it.

The Indian Ocean, together with the Mediterranean, has connected people since ancient times, whereas the Atlantic and Pacific have had the roles of barriers or mare incognitum. The written history of the Indian Ocean, however, has been Eurocentric and largely dependent on the availability of written sources from the European colonial era. This history is often divided into an ancient period followed by an Islamic period; the subsequent periods are often subdivided into Portuguese, Dutch, and British periods.

#### Indian Ocean world

A concept of an "Indian Ocean World" (IOW), similar to that of the "Atlantic World", exists but emerged much more recently and is not well established. The IOW is, nevertheless, sometimes referred to as the "first global economy" and was based on the monsoon which linked Asia, China, India, and Mesopotamia. It developed independently from the European global trade in the Mediterranean and Atlantic and remained largely independent from them until European 19th-century colonial dominance. The diverse history of the Indian Ocean is a unique mix of cultures, ethnic groups, natural resources, and shipping routes. It grew in importance beginning in the 1960s and 1970s and, after the Cold War, it has undergone periods of political instability, most recently with the emergence of India and China as regional powers.

#### First settlements

Pleistocene fossils of *Homo erectus* and other pre-*Homo sapiens* hominid fossils, similar to *H. heidelbergensis* in Europe, have been found in India. According to the Toba catastrophe theory, a supereruption c. 74,000 years ago at Lake Toba, Sumatra, covered India with volcanic ashes and wiped out one or more

lineages of such archaic humans in India and Southeast Asia.

#### Africa theory about *Homo sapiens*

The Out of Africa theory states that *Homo sapiens* spread from Africa into mainland Eurasia. The more recent Southern Dispersal or Coastal hypothesis instead advocates that modern humans spread along the coasts of the Arabic Peninsula and southern Asia. This hypothesis is supported by mtDNA research which reveals a rapid dispersal event during the Late Pleistocene (11,000 years ago). This coastal dispersal, however, began in East Africa 75,000 years ago and occurred intermittently from estuary to estuary along the northern perimeter of the Indian Ocean at a rate of 0.7–4.0 km per year. It eventually resulted in modern humans migrating

from Sunda over Wallacea to Sahul (Southeast Asia to Australia). Since then, waves of migration have resettled people and, clearly, the Indian Ocean littoral had been inhabited long before the first civilisations emerged. 5000–6000 years ago six distinct cultural centres had evolved around the Indian Ocean: East Africa, the Middle East, the Indian Subcontinent, South East Asia, the Malay World and Australia; each interlinked to its neighbours.

Food globalisation began on the Indian Ocean littoral c. 4,000 years ago. Five African crops — sorghum, pearl millet, finger millet, cowpea and hyacinth bean — somehow found their way to Gujarat in India during the Late Harappan (2000–1700 BC). Gujarati merchants evolved into the first explorers of the Indian Ocean as they traded African goods such as ivory, tortoise shells, and slaves. Broomcorn millet found its way from Central Asia to Africa, together with chicken and zebu cattle, although the exact timing is disputed. Around 2000 BC black pepper and sesame, both native to Asia, appear in Egypt, albeit in small quantities. Around the same time the black rat and the house mouse emigrate from Asia to

Egypt. Banana reached Africa around 3000 years ago.

### Pre historic tsunamis

At least eleven prehistoric tsunamis have struck the Indian Ocean coast of Indonesia between 7400 and 2900 years ago. Analysing sand beds in caves in the Aceh region, scientists concluded that the intervals between these tsunamis have varied from series of minor tsunamis over a century to dormant periods of more than 2000 years preceding megathrusts in the Sunda Trench. Although the risk for future tsunamis is high, a major megathrust such as the one in 2004 is likely to be followed by a long dormant period. A group of scientists have argued that two large-scale impact events have occurred in the Indian Ocean: the Burckle Crater in the southern Indian Ocean in 2800 BC and the Kanmare and Tabban craters in the Gulf of Carpentaria in northern Australia in 536 CE. Evidences for these impacts, the team argue, are micro-ejecta and Chevron dunes in southern Madagascar and in the Australian gulf. Geological evidences suggest the tsunamis caused by these impacts reached 205 m above sea level and 45 km inland. The impact events must have disrupted human settlements and perhaps even contributed to major climate changes.

### Maritime trade

The history of the Indian Ocean is marked by maritime trade; cultural and commercial exchange probably date back at least seven thousand years. Human culture spread early on the shores of the Indian Ocean and was always linked to the cultures of the Mediterranean and the Persian Gulf. Before c. 2000 BC, however, cultures on its shores were only loosely tied to each other; bronze, for example, was developed in Mesopotamia c. 3000 BC but remained uncommon in Egypt before 1800 BC. During this period, independent, short-distance oversea communications along its littoral margins evolved into an all-embracing network. The début of this network was not the achievement of a centralised or advanced civilisation but of

local and regional exchange in the Persian Gulf, the Red Sea, and the Arabian Sea. Sherds of Ubaid (2500-500 BC) pottery have been found in the western Gulf at Dilmun, present-day Bahrain; traces of exchange between this trading centre and Mesopotamia. The Sumerians traded grain, pottery, and bitumen (used for reed boats) for copper, stone, timber, tin, dates, onions, and pearls. Coast-bound vessels transported goods between the Indus Valley civilisation (2600-1900 BC) in the Indian subcontinent (modern-day Pakistan and Northwest India) and the Persian Gulf and Egypt.

### Exploration of the Ocean

The Red Sea, one of the main trade routes in Antiquity, was explored by Egyptians and Phoenicians during the last two millennia BC. In the 6th century, BC Greek explorer Scylax of Caryanda made a journey to India, working for the Persian king Darius, and his now-lost account put the Indian Ocean on the maps of Greek geographers. The Greeks began to explore the Indian Ocean following the conquests of Alexander the Great, who ordered a circumnavigation of the Arabian Peninsula in 323 BC. During the two centuries that followed the reports of the explorers of Ptolemaic Egypt resulted in the best maps of the region until the Portuguese era many centuries later. The main interest in the region for the Ptolemies was not commercial but military; they explored Africa to hunt for war elephants.

The Rub' al Khali desert isolates the southern parts of the Arabic Peninsula and the Indian Ocean from the Arabic world. This encouraged the development of maritime trade in the region linking the Red Sea and the Persian Gulf to East Africa and India. The monsoon (from *ma'wsim*, the Arabic word for season), however, was used by sailors long before being "discovered" by Hippalus, in the 1st century. Indian wood have been found in Sumerian cities, there is evidence of Akkad coastal trade in the region, and contacts between India and the Red Sea dates...

archipelagoes of the central Indian Ocean, the Laccadive and Maldivé islands, were probably populated during the 2nd century B.C. from the Indian mainland. They appear in written history in the account of merchant Sulaiman al-Tajir in the 9th century but the treacherous reefs of the islands were most likely cursed by the sailors of Aden long before the islands were even settled.

### Settlement of Madagascar

Periplus of the Erythraean Sea, an Alexandrian guide to the world beyond the Red Sea — including Africa and India — from the first century CE, not only gives insights into trade in the region but also shows that Roman and Greek sailors had already gained knowledge about the monsoon winds. The contemporaneous settlement

of Madagascar by Austronesian sailors shows that the littoral margins of the Indian Ocean were being both well-populated and regularly traversed at least by this time. Albeit the monsoon must have been common knowledge in the Indian Ocean for centuries. The Indian Ocean's relatively calmer waters opened the areas bordering it to trade earlier than the Atlantic or Pacific oceans. The powerful monsoons also meant ships could easily sail west early in the season, then wait a few months and return eastwards. This allowed ancient Indonesian peoples to cross the Indian Ocean to settle in Madagascar around 1 CE.

### Trade with Tamil Kingdoms

In the 2nd or 1st century BCE, Eudoxus of Cyzicus was the first Greek to cross the Indian Ocean. The probably fictitious sailor Hippalus is said to have learnt the direct route from Arabia to India around this time. During the 1st and 2nd centuries AD intensive trade relations developed between Roman Egypt and the Tamil kingdoms of the Cheras, Cholas

and Pandyas in Southern India. Like the Indonesian people above, the western sailors used the monsoon to cross the ocean. The unknown author of the Periplus of the Erythraean Sea describes this route, as well as the commodities that were traded along various commercial ports on the coasts of the Horn of Africa and India circa 1 CE. Among these trading settlements were Mosylon and Oponé on the Red Sea littoral.

Unlike the Pacific Ocean where the civilization of the Polynesians reached most of the far-flung islands and atolls and populated them, almost all the islands, archipelagos and atolls of the Indian Ocean were uninhabited until colonial times. Although there were numerous ancient civilizations in the coastal states of Asia and parts of Africa, the Maldives were the only island group in the Central Indian Ocean region where an ancient civilization flourished. Maldivians, on their annual trade trip, took their oceangoing trade ships to Sri Lanka rather than mainland India, which is much closer, because their ships were dependent of the Indian Monsoon Current.

### References

1. Demopoulos, Smith & Tyler 2003, Introduction, p. 219
2. Keesing & Irvine 2005, Introduction, p. 11-12, Table 1, 9.12
3. CIA World Fact Book 2018
4. Eakins & Sharman 2010
5. Harper, Douglas. "Indian Ocean".
6. Anonymous (1912). Periplus of the Erythraean Sea
7. Prange 2008, Fluid Borders : Encompassing the Ocean, pp. 1382-1385
8. World Map / World Atlas/ Atlas of the World Including Geography facts and Flags – World Atlas.com.