

# ENVIRONMENTAL ATLAS OF ABU DHABI EMIRATE



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The maps in this atlas are not authorities on international or inter-emirate boundaries, they only represent the extent of each individual study or set of data.

Though efforts were made to ensure that the statistics and data in this atlas are as current as possible, due to the nature of the printed format we cannot guarantee that all content reflects the up-to-date knowledge available today.

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# THE ENVIRONMENTAL ATLAS OF ABU DHABI EMIRATE

*Climate Change, Sustainability, Resource Protection, Endangered Species, Renewable Energy...*

Across the world, societies are becoming increasingly aware of the issues that affect life on Earth – our newspapers, magazines, television and cinema reflect on a daily basis our collective interest in our shared planet, Earth. Yet, even as we gain knowledge on a daily basis about how our living, physical, natural, and man-made environments are all interconnected, we are well aware that our understanding and appreciation of the environment has only begun to scratch the surface. This is a journey, and although collectively we have a long way to go, the direction is set.

The Emirate of Abu Dhabi, like its neighbours in the United Arab Emirates and the wider region, has a desert and marine environment of great beauty and value – the adaptations of the living world to Abu Dhabi's unique climatic conditions and physical geography are of immense scientific interest. The climate and physical geography, including the Emirate's water and oil resources, provide clues as to how the living world, including human societies, has changed and adapted over the ages. Gaining an understanding of this environment, and the challenges being faced, is crucial to developing appropriate policies and responses so that we can offer our children a sustainable future.

This *Environmental Atlas of Abu Dhabi Emirate* is designed to serve the diverse stakeholders of the Environment Agency - Abu Dhabi (EAD) and the wider community. It will be published in hard copy, digital and online formats, in both Arabic and English. It also represents one of the key products of an EAD major programme, the Abu Dhabi Global Environmental Data Initiative (AGEDI).

## THE AGEDI PROGRAMME

The Abu Dhabi Global Environmental Data Initiative (AGEDI) is a multi-faceted programme that provides simple, user-friendly access to high-quality environmental information through a variety of information products.

AGEDI was conceived by EAD in 2001 and launched by the UAE Government in 2002, during the United Nations World Summit for Sustainable Development in Johannesburg, South Africa. AGEDI operates on the local, regional and global levels, with EAD as its lead agency. The United Nations Environment Programme (UNEP) is AGEDI's main partner on the regional and global levels.

EAD and UNEP are currently implementing AGEDI Plan 2007–2012, a five-year strategy for the development and dissemination of interrelated environmental information activities and projects. In parallel with continuing national and international efforts, products developed at the Abu Dhabi level will be expanded to meet national, regional and global environmental information needs.

## ABOUT ENVIRONMENT AGENCY – ABU DHABI (EAD)

The Environment Agency – Abu Dhabi (EAD) was established in 1996 to preserve Abu Dhabi's natural heritage, protect our future, and raise awareness about environmental issues. EAD is Abu Dhabi's environmental regulator and advises the government on environmental policy. It works to create sustainable communities, and protect and conserve wildlife and natural resources. EAD also works to ensure integrated and sustainable water resources management, to ensure clean air and minimise climate change and its impacts.

## ABOUT THIS ATLAS

Often atlases are predominantly collections of maps or are technical in nature, targeting a narrow subject matter and/or an expert audience. Consequently, the information needs of key users, especially senior decision-makers, business executives, policy-makers and community leaders, are often neglected, as well as the wider public with a growing interest in environmental issues that impact their lives.

The *Environmental Atlas of Abu Dhabi Emirate* aims to be different. It has been prepared to address this information gap and embrace a wide constituency of readers in an innovative and compelling manner. The Atlas presents information within a common story and narrative, interwoven with complementary stories, case studies, facts and statistics, illustrative figures, anecdotes, photographs and thematic maps that highlight the most significant environmental aspects of the Emirate. The Atlas is designed to be highly accessible and communicative, presenting concepts and scientific information in a manner that is understandable to a wide audience.

The Atlas showcases the remarkable story of Abu Dhabi's environmental heritage and highlights its profound influence on the past, present and future of human and cultural development. By informing and educating the reader, it aims to raise awareness and present a call for action to protect the environmental richness and diversity of the Emirate.

## IN SEARCH OF A COMMON STORY

The Atlas presents a comprehensive and diverse range of themes covering history, geography, anthropology, natural sciences, culture, economics, social sciences and interrelated environmental themes, to name a few. They are addressed along a timeline that encompasses the past and present, as well as a sustainable vision for the future. To make the contents engaging, a common storyline brings unity to the diversity of themes and topics. The Atlas tells the following simple and engaging storyline:

The physical geography of the Emirate has evolved steadily over geological time involving episodes of both dramatic and subtle changes.

These formative forces resulted in the unique and fragile environment seen today, comprised of desert landscapes and their intricate interface with the sea.

Over millennia, the environment has constrained and shaped human development in complex ways through innovation, adaptation and survival. In short, the environment dictated the potential and fortunes of man.

In recent decades, the same environment has provided immense opportunities and potential through the extraction and utilisation of bountiful natural resources, namely oil and gas.

This bounty has propelled Abu Dhabi's development into the present impressive realm with rapid change, urbanisation, social development and widespread economic growth.

However, the future presents many unique challenges, especially how to re-invest this wealth and opportunity for the long term in a balanced and sustainable manner so that social, environmental and economic assets are available to future generations.

While in the past the environment shaped the destiny of human development, now humans have the technical capacity and resources to reshape the environment to meet future requirements. This poses serious challenges, not least in the responsible drive for sustainability – ensuring that by meeting the needs of the present, the aspirations of future generations are neither neglected nor compromised.

The challenges of sustainable development are complex and rich with both opportunities and risks. In addition, the sense of urgency is real within a dynamic global environment confronting the impacts of globalisation, climate change, resource shortages, loss of habitats and species, geopolitical instability, mass migration, threats to human health, nutrition and endemic poverty amongst others.

The *Environmental Atlas of Abu Dhabi Emirate* presents this story and the interwoven themes within a compelling, accessible showcase. It highlights what is unique about the environment of Abu Dhabi, how the past shaped the pathway towards the present, and how the lessons learnt from this experience should be applied to attain a sustainable future.



# CREDITS

This extensive, though non-exhaustive, list of acknowledgements and contributors paints a clear picture of the amount of collaboration required to make this groundbreaking publication possible. As the driving force behind this collaboration, the Environment Agency – Abu Dhabi (EAD), with this atlas, has achieved another milestone in the dissemination of the Emirate’s environmental heritage. Led by their Secretary General, H.E. Razan Khalifa Al Mubarak, EAD has once again proven to be a transformative force in defining a new generation of environmental awareness.

A deep appreciation also goes to the Geographic Planning Collaborative, Inc. (GPC), for their heavy involvement in developing the content for this atlas and reaching out to the many stakeholders involved in a project of this scale. Special thanks to the countless other individuals and organisations, which we don’t have the space to list here, who came forward to contribute to this work with open-armed support.

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Understanding the need to develop something that could capture the environmental science, heritage and future of the Emirate of Abu Dhabi in a succinct, yet creative format, a handful of individuals embraced the idea of creating the *Environmental Atlas of Abu Dhabi Emirate*.

For constructing a reliable backbone of support and providing the resources necessary to accomplish the polished pages that follow, we proudly acknowledge the following individuals who were essential to achieving this landmark’s calibre.

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# GEOGRAPHIC INHERITANCE

## LANDSCAPES FROM SEA TO SUMMIT

The spectacular landscape of the Emirate of Abu Dhabi represents an ancient and unique inheritance. From the highest mountain ridge to submerged coastal reefs, the diverse and often striking features show evidence of powerful forces that have progressively shaped and sculpted the landscape seen today. Some of these formative forces, were truly phenomenal in magnitude and timescale, involving the movement and collision of continental plates. In addition, the fluctuating state of the Arabian Gulf has, at various times over the few million years of its existence, sustained a vast wind-blown desert and a meandering river basin as well as the present extraordinary sea. Combined, these formative forces brought dramatic changes and also left a profoundly significant inheritance below the surface. Rock formations and geological structures have allowed the accumulation of essential resources. These include both water within vast subterranean aquifers and the bountiful oil and gas reserves, which continue to transform the Emirate beyond recognition.

The key to understanding the present landscape and its features rests within events in the distant geological past. However, there are also contemporary forces at work today, which are equally influential. In particular, dynamic climatic patterns that influence aridity, wind, rainfall and temperature fluctuations continually erode the surface rocks to produce a diversity of

landforms shrouded with varying sediments and soils. For example, the dramatic dune fields that typify the deserts of the Emirate have their origins in the distant past. But they too are mobile and ever changing, with characteristic dimensions dictated by the subtle, wind-blown movements of individual sand grains.

The epic and evolving story of the Emirate's geographic inheritance is marked by the dramatic interface between land and sea from the macro to the micro-scale, from the distant past to present and future, and from sea to summit. This provides the background and context for understanding an intricate environment that continues to impact and is impacted by human development. While the clues to understanding the past rest within the characteristics of today's landscape, there are valuable insights to be gained from the restless Earth regarding the challenges of a rapidly changing environment.

Photograph

Abu Dhabi, between  
Al Khaznah and Sweihan



# EARLIEST ORIGIN

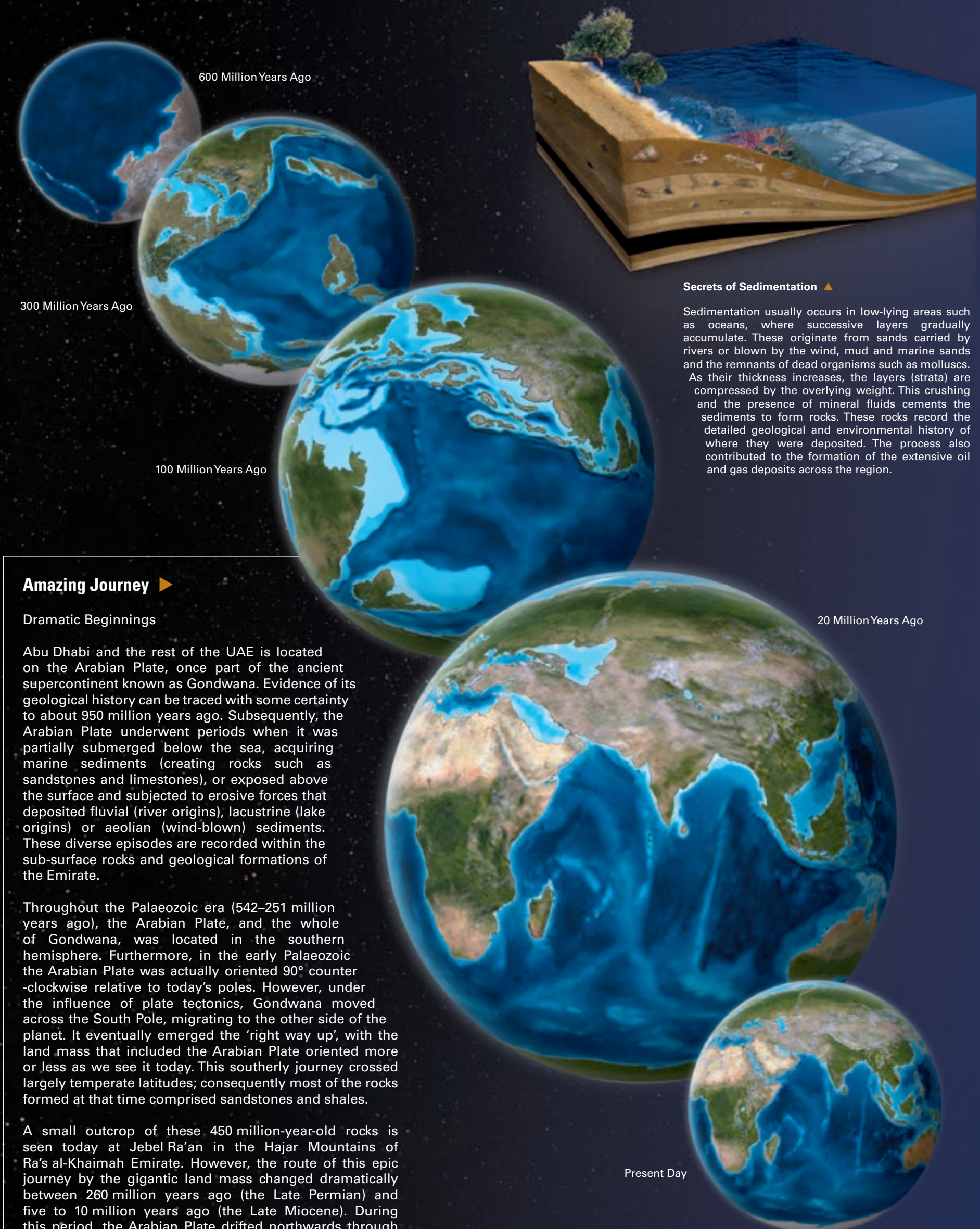
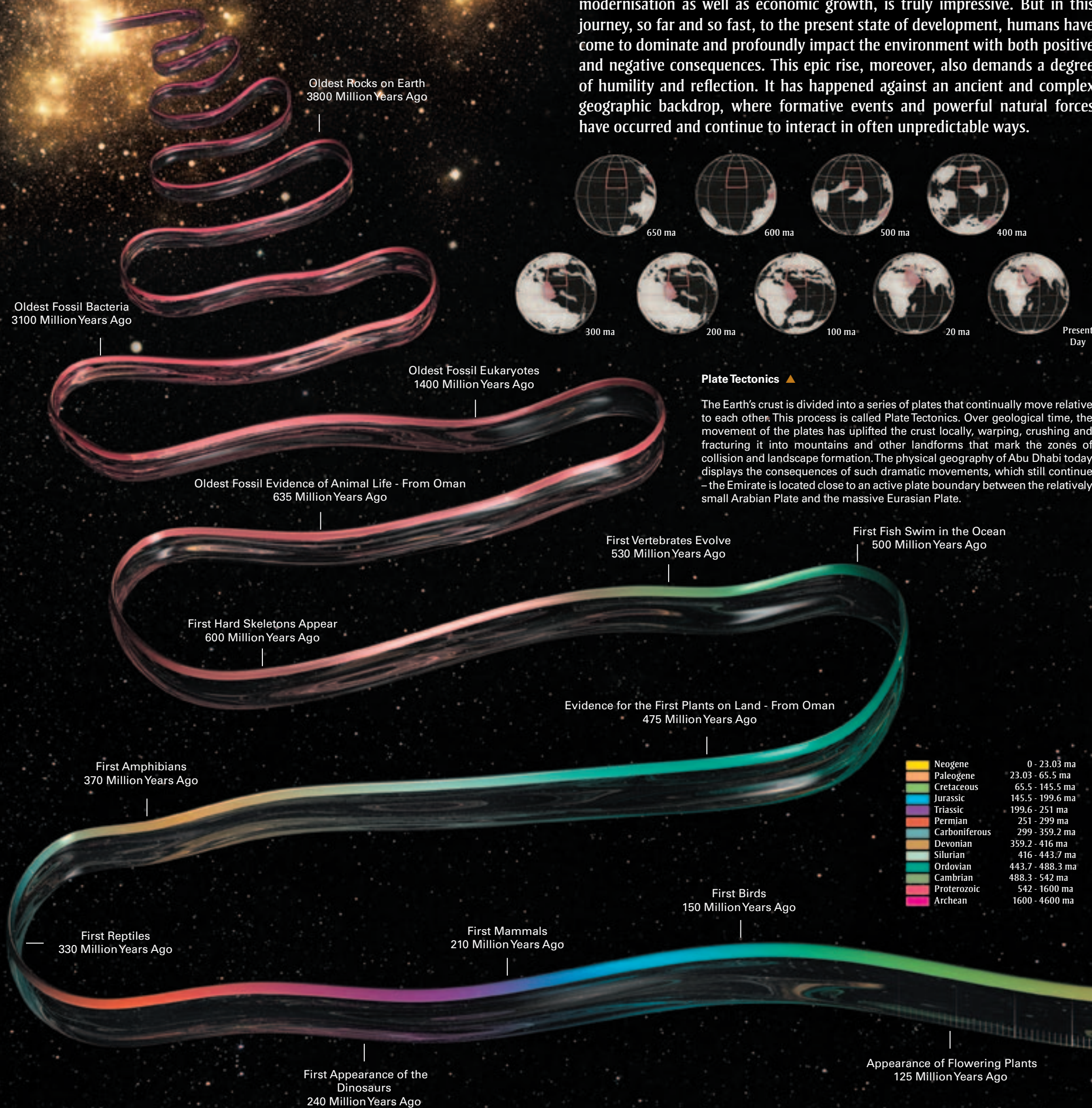
## CONTEXT OF GEOLOGICAL TIME

To appreciate the geographic inheritance of Abu Dhabi, it is important to have a chronological as well as a spatial perspective on the evolution of the environment and the unique physical features observed today. This requires thinking in terms of tens and hundreds of millions of years, which, in comparison to our own momentary lifespans, presents a major challenge. The geological timescale displayed in the diagram is divided into distinct eras, periods and epochs within which the physical geography of Abu Dhabi developed and continues to evolve.

To make this chronological context and formative events more understandable, it is helpful to relate the Earth's age to our own. The planet is around 4.6 billion years old. If compared to a person in their mid-forties, this would mean that one of our years is equivalent to around 100 million years in geological time. A single day is equivalent to around 275,000 years and an hour to around 11,000 years.

Using this perspective, the emergence of modern humans on Earth happened in the most recent day of their life. The rise of modern civilisations occurred within the last hour and dinosaurs dominated the planet less than a year ago. The entire history of Abu Dhabi can be accommodated in seconds, and the monumental growth and achievements since the discovery of oil within the blink of an eye.

Within this perspective, the relative speed of growth in Abu Dhabi, including modernisation as well as economic growth, is truly impressive. But in this journey, so far and so fast, to the present state of development, humans have come to dominate and profoundly impact the environment with both positive and negative consequences. This epic rise, moreover, also demands a degree of humility and reflection. It has happened against an ancient and complex geographic backdrop, where formative events and powerful natural forces have occurred and continue to interact in often unpredictable ways.



### Amazing Journey ▶

#### Dramatic Beginnings

Abu Dhabi and the rest of the UAE is located on the Arabian Plate, once part of the ancient supercontinent known as Gondwana. Evidence of its geological history can be traced with some certainty to about 950 million years ago. Subsequently, the Arabian Plate underwent periods when it was partially submerged below the sea, acquiring marine sediments (creating rocks such as sandstones and limestones), or exposed above the surface and subjected to erosive forces that deposited fluvial (river origins), lacustrine (lake origins) or aeolian (wind-blown) sediments. These diverse episodes are recorded within the sub-surface rocks and geological formations of the Emirate.

Throughout the Palaeozoic era (542–251 million years ago), the Arabian Plate, and the whole of Gondwana, was located in the southern hemisphere. Furthermore, in the early Palaeozoic the Arabian Plate was actually oriented 90° counter-clockwise relative to today's poles. However, under the influence of plate tectonics, Gondwana moved across the South Pole, migrating to the other side of the planet. It eventually emerged the 'right way up', with the land mass that included the Arabian Plate oriented more or less as we see it today. This southerly journey crossed largely temperate latitudes; consequently most of the rocks formed at that time comprised sandstones and shales.

A small outcrop of these 450 million-year-old rocks is seen today at Jebel Ra'an in the Hajar Mountains of Ra's al-Khaimah Emirate. However, the route of this epic journey by the gigantic land mass changed dramatically between 260 million years ago (the Late Permian) and five to 10 million years ago (the Late Miocene). During this period, the Arabian Plate drifted northwards through the tropics where warm, shallow seas were ideal for the accumulation of thick beds of sediments through a process known as sedimentation, which had lasting and significant impacts on the regional geology.

