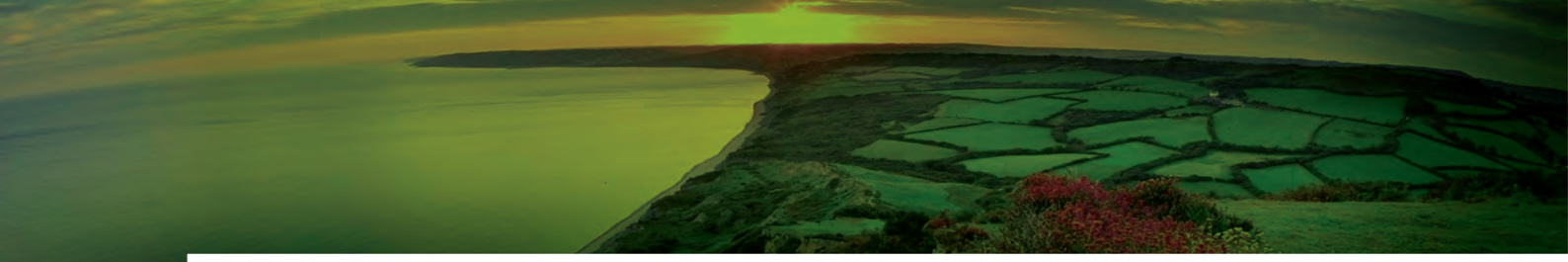

CHAPTER 11

Earth yesterday, today and tomorrow

Key words: Human distribution, land management, environmental change, climate change, global warming, mineral exploitation, exploitation of soils, exploitation of water, pollution.

Introduction

We live on a dynamic planet, where geological processes are continuously active and human interactions with natural systems can cause negative effects, even increasing potential risks to human populations. To avoid such scenarios, it is necessary to understand the dynamics of the Earth system and to learn how to sustainably live and interact with the planet by developing and respecting environmental management regulations.

11.1. The Earth before dawn of humans

The Earth was formed around 4,550 million years ago, but modern humans did not evolve until around 200,000 years ago. Life had appeared on the Earth by around 3500 million years ago under water and in the sea, evolving into many different types of organism, and eventually becoming widespread on land after around 400 million years ago. Climates and environments have changed due to the dynamics of the Earth's crust and small variations in the Earth's orbit, which have influenced the way landscapes are shaped by geomorphological processes.

11.2. Palaeoclimates and the impact of lithospheric dynamics on climate change

Ancient climates are recorded in rocks and testify to the dynamics of the tectonic plates that make up the Earth's surface. Mountain Belts are built up through the collision of these plates and are responsible for important changes in regional temperature and rainfall levels. Plate tectonics is also responsible for connecting and closing oceans and consequently influencing the distribution of heat, and hence climates, across the planet by changing major oceanic current systems. For instance, there are remains of glacial deposits dating from the end of the Palaeozoic Era in Antarctica, Australia, India, South Africa and South America which provide evidence that these continents have moved through time.

11.3. Human occupation and land management problems in drainage basins, coastal areas and on slopes

Depending on the geological and climactic characteristics of the region, human occupation and activities have the potential to increase fluvial erosion and flooding, as well as increasing coastal erosion, slope erosion, landslide risk and groundwater pollution. Geologists can predict and help prevent the geological risks associated with these natural phenomena and establish appropriate land management systems.

11.4. Human beings as agents for environmental change

Human beings have developed the ability to transform their environment to improve its suitability for human society. Such technological development implies environmental impacts that may also adversely affect the quality of the environment, for instance by building large hydroelectric stations and changing drainage basins, building in coastal areas and on alluvial flood plains and hence increasing the risk of flooding, deforesting mountain areas and provoking landslides, overexploiting of natural resources, etc.

11.5. Global warming

The development of our modern society has been dependent on the burning of fossil fuels for industry, transport and electricity production. This process releases large amounts of CO_2 to the atmosphere that can have a greenhouse effect and consequently contribute to raising the average temperature of the Earth.

11.6. Exploitation of minerals, ornamental rocks and other geological raw materials

The geological resources that we use to make everyday objects and for buildings and other constructions are considered to be essential raw materials. Due to their localised distribution in the Earth's crust, however, most of these are non-renewable resources. The most commonly used are sand, clays, and hard rocks such as sandstone, limestone and marble.

11.7. About environmental pollution

In modern societies, pollution affects water resources, the atmosphere and soils. Only a fundamental change of attitude can help reduce this pollution, with the implementation of environmental measures such as reducing the burning of hydrocarbons, improved refuse and waste water management and the protection of water reservoirs. Pollution is a major threat to the health and stability of the ecosystems of our Planet and is consequent a very real threat to life, causing disastrous reductions in the numbers of many species, as well as potentially seriously affecting human life.

11.8. About the exploitation of soils

Although agriculture is the most ancient human practice of soil exploitation, it can also be the most damaging. De-forestation, over-cropping, use of fires and intensive grazing can all contribute to stop the regeneration of the nutrient content of soils.

11.9. About the exploitation and pollution of water resources

Water is a very important resource but can vary in its quality. Groundwater geological reservoirs, or aquifers, can store water which can be made accessible for human use. Unfortunately, however, the growth of global populations can increase water pollution across increasingly larger areas, including in both coastal regions and inland drainage basins. The source of this pollution is mainly from agriculture, industry and urban sources – including both human and runoff.

11.10. What regional and global environmental changes should be expected in the 21st century?

Although modern societies are growing faster and faster and human impacts on the environment are increasing, human consciousness about the environment is also beginning to change. Nevertheless, human pressure on the planet and on its geological resources is causing irreversible changes that could very seriously damage human health. Fortunately, however, people can now understand how they affect the planet and how to respect the dynamics of the Earth's systems through sustainable land management and development policies.

Intended learning outcomes:

- To understand the Earth as a global and dynamic system.
- Recognise the role of humans in the Earth system.
- Identify ways to manage planet Earth sustainability.

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