Year of the Blue Planet

Prof. Andrzej Żelaźniewicz is chairman of the Committee of Planet Earth and the Committee of Geological Sciences, Polish Academy of Sciences

ANDRZEJ ŻELAŹNIEWICZ
Committee of Planet Earth
Committee of Geological Sciences
Institute of Geological Sciences, Wrocław
Polish Academy of Sciences
pansudet@pwr.wroc.pl

The UN has declared 2008 the International Year of Planet Earth, an opportunity for pursuing ground-breaking research and promoting greater Earth-science awareness

Projects related to the Year of Planet Earth already began in 2007, and will continue into 2009. In Poland, like in nearly 100 other countries, exhibitions, demonstrations, competitions, radio and TV programs, brochures and flyers, and science festival events are being planned. A traveling exhibit entitled "10 Questions About the Earth - the Past for the Future" will focus on 10 main themes. After its grand inauguration at the Museum of the Earth in Warsaw (Polish Academy of Sciences) the exhibit will visit other Polish cities. In tandem with information posted on the Internet, it will form a cycle of presentations to showcase, in an easily-accessible way, the essence of the processes shaping the Earth System and the potential for harnessing its resources wisely. Organizing these efforts is one of the main tasks of the Committee of Planet Earth, set up by the Presidium of the Polish Academy of Sciences.

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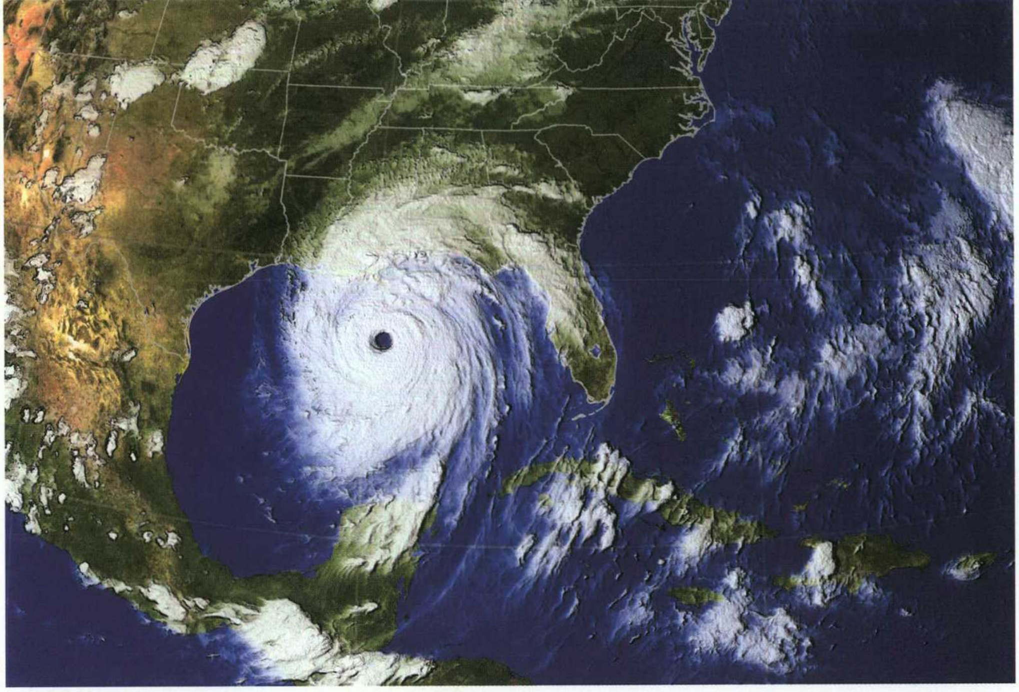
The logo of the International Year of Planet Earth features four colored arcs, symbolizing the lithosphere, hydrosphere, biosphere, and atmosphere - the four spheres of the Earth most crucial for mankind. Research on these spheres exerts a direct impact on the quality of life enjoyed by our globe's population: hence the slogan "Earth Sciences for Society."

Andrzej Żelaźniewicz

Snæfell volcano in Iceland - it was here that the characters of Jules Verne's novel began their *Journey to the Center of the Earth.* Nowadays it is a place where geologists study the dynamics of our globe's interior



Hurricane Katrina in the Gulf of Mexico – a terrible and beautiful sight. Scientists seek ways to predict such phenomena, or even to control them

This involves such important problems as access to drinking water, ecological catastrophes, climate change, natural resources, and processes that occur in the soil, under the Earth's surface, and deep in the oceans, plus the biosphere diversity that hinges upon these processes.

The struggle for water

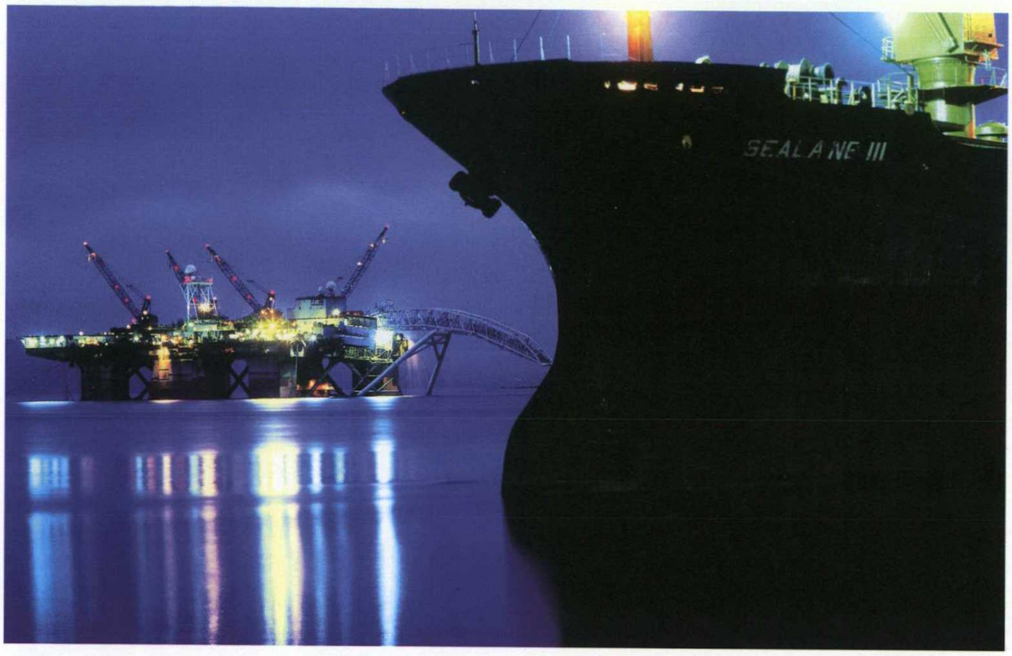
Our fresh water supply could run out if we do not manage it wisely. Mankind chiefly harnesses ground and surface waters, 90% of them in agriculture and industry. As the world population increases, so does water consumption. Groundwater resources are shrinking and the problem is further exacerbated by the pollution of surface waters. The desalinization of seawater represents an expensive and environmentally harmful solution - one available to Persian Gulf countries but not to poor Somalia, where drought is deadly. Poland, too, might face a water shortage if underground reservoirs are emptied faster than they are filled by incoming rainwater. Even in water-poor countries, however, there might exist as-yet unknown groundwater reservoirs that only new research can discover.

Systematic meteorological observations began in Europe in the 18th century, yet it was only discovered in the early 20th century that weather is dictated by atmospheric fronts, oceanic currents, trade winds, and vegetation cover, in complex interdependencies that are still ill-understood. In the medium latitudes, weather forecasts stretching more than 7 days ahead are still uncertain, even though there are 10,000 synoptic stations operating in the world nowadays, supported by 10 satellites. The question of to what extent our civilization has contributed to the observed climate change remains insufficiently understood. A definitive answer must be based upon reliable knowledge about climate change conditions existing in the past - obtainable through further research on oceanic and lake deposits and tree rings, for instance.

With the rise in the Earth's population, by around 2030 more than 60% of humanity will be living in cities. The number of megacities, with populations upwards of 10 million, is increasing at an alarming rate, especially in the Third World. They are located along the seacoast, where they are increasingly exposed to natural catastrophes - hurricanes, tsunamis, earthquakes. Although the famine disaster foretold by Malthus will probably not come true, we can expect there to be billions of people living in slums. Aside from infrastructure and social problems, such agglomerations will face a lack of land to build on. The cities of the future will have to expand not only upwards, via ever-higher towers, but also downwards, heading underground. Such facts, plus the need to ensure a water supply for these city dwellers, will pose new challenges to geology and the other Earth sciences.

Treasures in darkness

Three-quarters of the Earth's surface is covered by saltwater, one of the products of the evolution of matter on our planet. While water plays a certain part in processes taking place underground, it has a fundamental impact on nearly everything that occurs on the surface. Over the past 40 years, research on the seas and oceans has been augmented with programs of drilling into their bottoms. The samples of deposits and rocks thus extracted preserve a record of the past 200 million years in the Earth's history. One of the most important fields requiring further research is how the lithosphere, hydrosphere,



East News

The exhaustion of mineral deposits makes it crucial to quickly develop new prospecting and mining techniques

and biosphere interact within the middle-oceanic ridge zones. Outpourings of basaltic lavas are there accompanied by outflows of very hot water (300-350°C). Even though the water from such springs is saturated with poisonous compounds there are rich oases of life around them, based on chemosynthesis rather than photosynthesis. These hot solutions carry large quantities of metals, which form huge ore concentrations planned to be mined in the future. The seas also collect the wastes of mankind's activity, carried down rivers to pollute coastal areas. Sea hydrodynamics and the circulation of suspended compounds and biogenic substances (nitrogen, phosphorus, sulfur) represent still more problems which the Earth sciences have to resolve.

Mineral resources underpin all of mankind's economic activity; without them we would still be living simple lives without all of the conveniences painstakingly invented over history - out of copper, bronze, iron, and ultimately silicon. Geology and mining are still important sciences, because nearly all natural resources are non-renewable. Some of them, such as hydrocarbons, will run out in the quite near future. One method of coping involves searching for alternative energy supplies and metal substitutes, others involve seeking new deposits and new natural resources, developing new technologies for their extraction, and wisely harnessing them without harming nature.

It was most likely around 2 billion years ago that the first blue-green algae appeared in the ancient ocean, giving off oxygen in the process of photosynthesis, thus boosting the oxygen content in the Earth's atmosphere. That oxygen increase was catastrophic for life at that time: 1.8 billion years ago, eukaryotes survived that catastrophe by developing an oxygen-based metabolism. That paved the way for the emergence of today's world of people and animals. With time, the presence of oxygen likewise led to the formation of an ozone layer, protecting the biosphere from ultraviolet radiation.

The biosphere interacts in complex ways with the lithosphere, hydrosphere, and atmosphere. Aside from supplying oxygen into the atmosphere, the biosphere also builds reefs and other biogenic rocks, is an important link in the hydrological chain, has a significant impact on climatic events, and participates in the self-sustaining food chain, crucial for biosphere diversity. The task of the Earth sciences is to study these four spheres and to seek ways of maintaining their stability, ensuring that the Earth's inhabitants can develop safely.

The Earth's skin

Soils represent a kind of skin of the continental crust, in which all vegetation is rooted. Soils form through the weathering of rocks and the impact of living organisms. They consist of small mineral and organic particles, together with water, vapor, and other gasses. The composition of this mixture depends on the type of underlying rock. Controlled changes in the proportions of the three phases making up soil have been a subject of human activity since time immemorial. Soil science, also known as pedology, strives to identify the processes involved in soil formation and identify ways of altering their properties. Soil's capacity to store water is of vast significance for the flow of surface waters, for the hydrological cycle, and for plants. Deforestation causes soil erosion, depriving it of its water-storing ability. The soils weathered away from a given area do not become completely lost, as they gather in river alluvia and delta deposits or as loess. Environmental pollution nevertheless lowers their quality, making study and constant monitoring so important.

Geology and medicine, at first appearance, seem to be unrelated sciences. Yet every day we consume plants that grow in soil and breathe air that contains dust and gas from deep inside the Earth. Some mineral substances present in water and food are crucial for the human body's proper development and function. The task of medical geology, a field now just emerging with great potential, is to identify which elements, ions, and mineral substances occur in soils and water in harmfully excessive (or harmfully insufficient) quantities.

An active planet

The Earth was born some 4.6 billion years ago from the condensation of cosmic dust and gas, forming the spherical structure of the globe - with a core whose outer portion is liquid, a mantle, and a vastly diverse but very thin crust. Mankind, living on the turbulent border between lithosphere and atmosphere, needs to know about and understand what is going on above our heads and below our feet. Growth of the crust along the oceanic ridges or collisions of tectonic plates may give rise to earthquakes and volcanic eruptions, and these in turn can cause tsunami waves. The phenomena occurring in the Earth's mantle and their links to the lithosphere we live on are nevertheless still very ill-understood. Only the further development of the Earth sciences will enable us to more safely harness its resources while avoiding the dangers lurking deep within the globe.

The forces of nature manifest their destructive power to us in the form of earthquakes, volcanic eruptions, tsunami waves, hurricanes, mudslides, forest fires, cold snaps, droughts, and floods. While it is hard to oppose the power of nature, we are no longer completely defenseless against it. Many oncoming catastrophes can now be foreseen by monitoring stations, and proper preparations can be made to mitigate the danger and losses. Scorning the possibilities offered by science may have tragic consequences: the tsunami in December 2004 took a toll of 230,000 lives because the governments of the countries affected had not deemed it necessary to fund an early-warning network. Poland is fortunately far from areas volcanically or seismically active, but weak earthquakes can even occur in our country. The role of the Earth sciences is to warn the public and state authorities about such natural hazards.

The International Year of Planet Earth will in fact coincide with the International Heliophysical Year, the International Polar Year, the Electronic Geophysical Year, the Geographic Union Congress, and the International Geological Congress, and so a true Earth-science fest awaits us in 2008. ■

Further reading:

www.yearofplanetearth.org. Website of the International Year of Planet Earth.

www.planetaziemia.pan.pl. Website of the PAN Committee of Planet Earth [in Polish].

Mankind's industrial activity has to be planned wisely to prevent it from harming the natural environment

Andrzej Pieńkowski