

THE BENEFITS OF PLAYING WITH ROCKS

Most people view examining fossils as a kind of hobby, and only a lucky few have managed to turn it into their profession. But is there money to be earned from it? And what benefits does the taxpayer stand to gain?



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The past two decades in Poland have abounded in discoveries of spectacular paleontological sites, often of stunning, world-class caliber. *Nature* published a report from the Holy Cross Mountains on tracks left behind by the oldest terrestrial vertebrates in the Devonian, a finding that shook the existing, seemingly well-documented, reconstructions of the emergence of amphibians from fish. In same region, scientists have also discovered other fossils from that period, namely the remains of the *Dunkleosteus*, a gigantic armored fish, as well as other numerous representatives of this extinct class – including findings that shed new light on a problem widely discussed in science, namely the question of which animals teeth first developed in, and what they developed from.

At the sites of Krasiejów and Lisowice in Poland's Silesia region, in turn, graveyards of reptiles and huge amphibians from over 200 million years ago (the Triassic) have been found. In Krasiejów, 15 previously unknown species or genera of different animals have been documented, including one of the earliest pre-dinosaurs (attributed to dinosauromorphs); in Lisowice, scientists discovered Poland's oldest remains of mammals and dinosaurs, flying reptiles, and

the world's largest herbivorous representatives of the mammal-shaped reptiles (a group of creatures that ruled on land before the age of dinosaurs).

In Gdańsk, on the other hand, a piece of amber with an almost complete lizard that lived 40 million years ago found its way into the hands of researchers. A truly unique specimen, one of only a few vertebrates that have ever been found in Baltic amber – in 400 years of collecting of fossil inclusions and mining tens of thousands of tons of amber from the Baltic Sea. In addition, many new species of insects, arachnids, etc. were first found in Polish amber in the twenty-first century. And in the village of Owadów, a real treasure-trove of diverse and perfectly preserved Jurassic fauna was uncovered by bulldozers. It has yielded the remains of sea reptiles, including turtles, accumulations of horseshoe crabs and other lobster-like arthropods rarely found in the fossil material, and also organisms as delicate as dragonflies and grasshoppers.

The year 2010 brought Poland a particularly unique distinction to add to its European credentials: after a century and a half of searching, remains of a Neanderthal, perhaps the only human species to have evolved on the Old Continent, were found in Poland for the first time.

Identifying strata

The above discoveries are great examples of the outstanding scientific potential inherent in Poland's fossils. However, in today's times of global financial crises, budget deficits, and calls for more frugal spending

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The Krasiejów dinosaur park and pavilion, situated over an exposed layer containing skeletons of Triassic vertebrates.

of public funds, the question of the practical effect of money spent on science is certainly in vogue. In many fields of the Earth sciences the answer is simple. Everybody knows what material benefits come from searching for oil, gas, gold or other metal ores. Money spent on researching groundwater or geological engineering issues is equally indispensable, as otherwise it would be impossible to erect safely any tall building. But the average citizen finds it much harder to see any economic justification for paleontological research. Nevertheless, knowledge of the fossilized remains of ancient organisms turns out to be quite useful for the economy.

Until recently, global power generation was based on coal; in Poland it remains so. Coal deposits consist mainly of numerous strata located deeply underground, separated by gangue rock strata. To determine the profitability of potential mining operations, one must drill a series of boreholes and compare the samples taken from each of them to be able to assess which coal horizons are spread over a large area, and which

are only local. However, identify a specific deposit as it runs through subsequent boreholes is not easy, as rock layers are often folded, torn and chaotically shifted by faults. The same layer may be of considerable thickness in one place, disappear in a second, then reappear in the next, albeit at a different depth and running at a different angle. So how might it be recognized as being the same layer? Well, coal comes from plants, and its individual layers usually contain different assemblages of pollen and spores, due to differences in age and the environment in which the plants grew. This assemblage of the microfossils therefore serves as a diagnostic for identifying a given level of coal. In turn, fossilized marine microorganisms (e.g. foraminifers) are commonly used in finding and dating potentially oil- and gas-bearing structures.

The monetary value of an insect in amber

For centuries, the extraordinary treasure of the Polish regions of Pomorze Gdańskie, Kurpie and Kashuby has been Baltic amber – 40-million-year-old fossilized resin, originating from prehistoric conifer trees in Scandinavia. Currently, Poland is one of the main centers for processing and trade of amber, which fetches impressive prices: one ounce of amber costs several times more than an ounce of silver. And when an amber piece contains a fossilized insect, even of a common species, its value soars. The price skyrockets even higher if a paleontologist determines that the sunken specimen is authentic and represents a unique species of fly, spider, or vertebrate. For example, a lump weighing only 7g, but containing a lizard inclusion, was sold for 85,000 PLN (27,200 USD) in 2006. Exhibits of this kind are important for the prestige of natural history museums, as they are magnets attracting tourists from around the world. The aforementioned lizard

A rock garden made of petrified wood (Góra św. Anny, Opole province).



Photo 1.

A part of the jaw of a Triassic predatory sea reptile from Krapkowice (Geological Museum, University of Wrocław).



Photo 2.

Triassic sponges on Góra św. Anny.

Photo 3.

The skull of a Triassic amphibian from Krasiejów, placed next to a human skull for comparison (specimen from the exhibition at the Wrocław University of Environmental and Life Sciences).



Photo 4.

A fossilized Triassic sea lilies from Krapkowice (Geological Museum, University of Wrocław).

Photo 5.

A leaf inside a piece of 40-million-year-old Baltic amber (the amber collection of the Malbork Castle Museum).



has become the marketing symbol of the newly created Amber Museum in Gdańsk, helping make the institution one of the most important attractions of the city.

Tourists following tracks

Discoveries of spectacular fossils may provide an excellent opportunity to promote a region and help it prosper. In 2000, together with Prof. J. Dzik's team, I published an article on the skeletons of amphibians exceeding 2m in length that we had excavated in Krasiejów, as well as dinosaurs (later classified as dinosauromorphs). From then on, Krasiejów, previously a virtually unknown village without any significant tourist attraction, began to attract 6,000 tourists a year. In 2005 and 2006, two small paleontological museums were established there, which doubled the number of visitors. In 2010, at an expense of over 40 million PLN (over 13.5 million USD), an educational dinosaur park was opened next to the fossil-bearing deposits, with a display of reconstructed local Triassic fauna. This has placed Krasiejów among the biggest tourist attractions of the Opole region, visited by a quarter of a million people each year. Something similar happened with the Jurassic dinosaur footprints found in Bałtów (in the Świętokrzyskie province) – another ex-

ample when a paleontological discovery contributed to the establishment of a small exhibition and museum center in a village, attracting crowds of tourists and stimulating the local economy.

Still, even spectacular and much-publicized finds will not generate mass tourism just on their own. To achieve such commercial success as in the cases of Krasiejów and Bałtów, it is necessary to develop the right, scientifically accurate exhibition content to ensure its educational value, while at the same time giving it a modern, visually attractive flair, captivating enough to ensure that visitors, who mostly come from far afield, will want to spend a longer time there. It is also necessary to build complete tourist infrastructure. The whole project therefore requires a well-thought-out vision, scientific and economic knowledge, as well as considerable financial resources. And unfortunately, the fossils have to be capable of capturing the media limelight. Although centimeter-long bivalve shells or even the shells of marine plankton invisible to the unaided eye may have more value for scholars than the skeleton of a dinosaur or mammoth, ordinary people are generally only excited to see extinct animals that were large or terrifying – or ideally, both.

But that does not mean that an absence of big investors and toothy ancient monsters will make

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a paleontological site valueless for the economy. Recently, Poland has witnessed an intensive upswing in geotourism, i.e. the pastime of visiting places displaying interesting geological resources and also the harnessing of those resources by man, in the form of mines, lime kilns, and even buildings erected from local rocks. Hoping to attract geotourists (and their money), old quarries are being revitalized, educational trails are being laid, and private and local government museums are being established. The above-mentioned discoveries in Lisowice and Zachełmie have brought both villages media promotion, a rapid increase in their visitor streams, small investments in road infrastructure, and the creation of a museum in the first case, and the laying out of an educational route in the quarry in the second case. The attractiveness and publicity of these places, in turn, also benefits dozens of agritourism farms and hotels located nearby, as well as tour companies offering trips to them.

In 2007 and 2012, my colleagues and I wrote geotourist guides for the Góra św. Anny region (central part of the Opole province), which abounds in captivating fossils, geological forms, landscapes and monuments of the mining industry. They are fascinating in their diversity: during just a short trip one can essentially page through a veritable whole textbook

of the Earth sciences: rocks formed in different eras, representing different environmental conditions and forms of the Earth's activity. There are over-one-billion-year-old, huge granite erratic boulders dragged in from far-off Sweden by the continental ice-sheet, sediments of the deep Carboniferous sea folded by gigantic orogenic movements, on top of them lying much younger sandstones of the hot Triassic desert, which in turn was flooded by a shallow subtropical sea, embedding thick limestone series, now being the region's treasure as an excellent raw material for the production of lime and cement. Moreover, there are some remains of volcanoes that smoked here only 20 million years ago, and cracks in the Earth's crust running for miles, along which the rock massifs of Chełm and the Eastern Sudetes were thrust up.

Improving on indifference

As we have seen, great promotional, economic and educational potential lies inherent in the discoveries made by both professional paleontologists and by none-too-numerous but enthusiastic amateur fossil hunters. However, such potential is unfortunately being wasted in Poland. In hundreds of Polish villages and towns there are quarries known for their dinosaur tracks, shark teeth, huge sea lizards, crocodile remains, ancient coral or sponge reefs, well-preserved snails or sea bivalves. During my research work in Scandinavia, I noticed that it is much more common there to establish exhibitions, to lay out tourist trails in such places, to publish folders related to them and hold field lessons there. Such efforts serve to showcase the extinct ancient world, while also drawing attention to the reasons for its rise and, importantly, for its ultimate demise – in the consequence of climate change and the attendant collapse of ecosystems, which is directly related to today's environmental problems. Many of these Scandinavian sites successfully attract thousands of visitors.

Meanwhile, the vast majority of Poland's equally attractive paleontological sites are known only to scientists and hobbyists. Attempts to attract the attention of the local authorities or nature conservation institutions too often prove futile, often hitting a wall of indifference, and excavation sites featuring unique traces of the past are all too frequently instead being treated as convenient landfills or dump areas. It is high time to put a stop to these wasteful, landscape-marring and environmentally hazardous practices, and to replace them with cooperation between local governments, scientific communities, and tourist companies. The examples of Krasiejów, Bałtów and St. Anne's Mountain show that such a strategy can successfully bring tangible educational, environmental, and financial benefits to local communities.

TEXT AND PHOTOS BY **ROBERT NIEDŹWIEDZKI**

Further reading:

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