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DOES EARTH STILL OFFER DISCOVERIES?

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Imagine a geoscientist who begins his career as a mine surveyor but who quickly realizes that this was too small a field for him. So, he decides to take field trips, which last many years, to remote parts of the Earth. What our geoscientist discovers includes nothing less than the interactions between topography and climate, the alignment of volcanoes along zones of earthquake activity and at great depth, and three-quarters of all known plant species. Returning home, our geoscientist does not rest. Instead, he lets the world know of his spectacular discoveries. He becomes a prolific writer who publishes an immense number of articles and books, all the while discussing the implications of his findings in a dozen or more detailed letters a day with colleagues around the world.

We are talking about the year 1800, when the world was still very much “terra incognita”. Discoveries were just waiting for those who had the courage and the resources to make them. Our geoscientist was Alexander von Humboldt (1769–1859), whose 250th birthday we celebrate in Germany this year. His findings and interpretations, the wealth of data he produced, and the specimens he collected, were so immense that they inspired Charles Lyell (1797–1875) to develop the theory that slow forces continuously shape the Earth and they helped stimulate Charles Darwin’s revolutionary theory that animal species evolve.

For many of us, contemplating the work of scientific giants such as Humboldt, Lyell and Darwin is a humbling experience. How minor, by comparison, are the advances we make with our daily work. How incremental is our progress, and how dependent are we on networks, large research infrastructure, and sophisticated laboratories. How little does scientific intuition seem to play a role anymore. Who of us actually ever make discoveries on a scale even close to our academic forebears?

Does this mean that we have no more heroes amongst us? Or are we simply running out of the potential for discoveries because the Earth is now “terra cognita”? Indeed, although the amount of material published doubles every decade or so, the sciences in general, and the Earth sciences in particular, often appear to have plateaued. One could argue that we now know so many of the fundamentals that further advances can only be incremental and occur at a pace at which we would barely even notice.

Or is the above perception quite wrong? Discoveries still happen, but today they do so less through individual genius and more through the concerted efforts of many individuals working together. To make progress, we often need sophisticated equipment, and science is, as a consequence, expensive. We do chart new territory, only we do it in a very different way from Humboldt and his French aide, Aimé Bonpland, who sailed to South America. It is inspiring to think how excited Humboldt would be with modern Earth science. Today, we explore the depths of the sea and the surfaces of other planets. We drill deep below the Earth’s surface – a world even more foreign to us than South America was to Humboldt – where discov-

eries of deep microbial ecosystems and geochemistry are just waiting to be made. Our computers simulate Earth processes in continuously increasing realism, as shown for subsurface fluid flow in this issue of *Elements*. We reconstruct the history of our solar system, and even search for life beyond Earth. In fifty years hence, all these activities have the potential to redefine the Earth sciences, just like those that surrounded the discoveries of Humboldt when he first climbed Chimborazo Volcano in Ecuador.

Another modern Earth science discovery underway comes courtesy of today’s industrial society, and it is not desirable. With the global-scale climate experiment caused by our self-made CO₂ we are currently conducting a “stress test” of the Earth system that will allow us to test the limits of stability, identify tipping points, and probe feedbacks in real time. This particular discovery is coming at a tremendous cost to Earth’s ecosystems and to the most vulnerable people who are living in climate-sensitive areas and who lack the means to adapt to the changes they face.

The task facing us is to alleviate the worst of this experiment, and it requires us to convince societies to act. Which brings me back to Alexander von Humboldt: he was a passionate advocate and communicator. After seeing South America in 1800, he was immediately aware of the damage humans wreak by intruding into landscapes and their ecosystems, and he expressed this concern widely and at all levels. He was a fierce opponent of slavery and voiced this view to politicians of the time. He counselled US President Thomas Jefferson (1743–1846) on the situation in South America, and frequently advised the French elite, Prussian kings, and the British prime minister on the latest scientific discoveries. But his science advocacy went far beyond presidents and royal courts. With a series of public lectures in the late 1820s – the “Cosmos Lectures”, held in Berlin (Germany) – he made science accessible to the general public. Half of his lecture halls were reserved for laymen, and were, for the first time ever, attended by women, who, at this time, were still banned from attending universities. These lectures were spectacular events, booked out months in advance, and later to appear as best-selling books. It was the dawn of popular science communication.

Given the ever-increasing relevance that all sciences have on our daily life, the terra incognita of our time may be its translation to our fellow citizens. And like Humboldt, we should not shy away from providing an ethical evaluation of their consequences. All this can – and should – be done, even if we’re not making big scientific leaps. That communicating our science to the public is just as worthwhile an achievement as the ‘scientific leap’ might be the best discovery that most of us can make.

Friedhelm von Blanckenburg
Principal Editor



Friedhelm von
Blanckenburg making
a discovery