NEIL THOMAS/AWL/GETTY

A Samburu warrior looks out over the Rift Valley in Kenya at sunset.

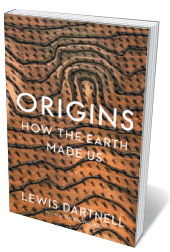
EVOLUTION

We are tied to tectonics

Kevin Padian applauds a book on Earth's role in human evolution and civilizations.

In this age of worldwide climatic deterioration, many authors have documented what we are doing to our planet. Lewis Dartnell turns the tables in his book *Origins*. He asks how Earth has affected us, through our long evolution to big brains, small jaws and scrawny bodies that somehow cooperate with each other enough to make us the planet's dominant eukaryotic species. All this began, Dartnell argues, with the tectonic processes that created the East African Rift — the area that today runs from Somalia and Ethiopia down to the coast of Mozambique. The uplift of mountains here caused a rain shadow that dried and warmed East Africa, turned jungle into a park-like savannah, and enticed early hominins to leave the trees and become game hunters, runners, thinkers, cooks and, eventually, empire builders.

The steps of this long, Earth-changing process are both generalizable and repeatable. Tectonic events push up vast sections of land, and these upraised rocks are then eroded, leading to nutrients and minerals being transported down to lower elevations, nurturing the development of agriculture in civilizations on various continents. In the same way, mountain ranges provide the headwaters for rivers such as the Nile, the Tigris and the Euphrates, allowing agriculture to prosper reliably in otherwise barren regions. We are tied to tectonics more than we admit, Dartnell argues.



Origins: How The Earth Made Us
LEWIS DARTNELL
The Bodley Head (2019)

But regional tectonic events alone can't account for fluctuations in worldwide temperature and moisture patterns over many tens of millions of years. Behind these is a complex system of vacillating astrophysical influences that include the eccentricity and shape of Earth's orbit, the tilt of its axis and the movements of the Sun. Even more complexity comes from one-time events, such as the collapse of the giant Lake Agassiz in Canada some 13,000 years ago, which caused water to drain into oceans, raised sea levels, stymied ocean circulation, changed climates half a planet away and might have frustrated nascent agriculture in the Middle East.

Deep time has a role, too. Subsurface pressure and temperature effects cause changes in the composition and properties of rocks, and from these we reap flint, chert, loess, kaolin, granite and clay. Most industrial iron today comes from banded iron formations, which mainly formed in the Precambrian era (600 million years ago and earlier). And environmental changes, including cooling and drying, on the plains and steppes of the world tens of millions ▶

of years ago provided opportunities for the evolution of grasses, horses and camels, all of which have been indispensable to humans. On a shorter timescale, the primacy of wood exploitation (where timber was available or could be traded for) gave way to the ages of bronze and then iron, as technology evolved to take advantage of copper and tin and to forge steel. Trade developed on both sea and land, and its corollaries ranged from cultural exchange to wars, all conditioned by geography and climate.

Such a grand sweep of history and prehistory could be chaotic, but Dartnell's story is beautifully written and organized. His infectious curiosity and enthusiasm tug the reader from page to page, synthesizing geology, oceanography, climatology, meteorology, geography, palaeontology, archaeology and political history in a manner that recalls Jared Diamond's classic 1997 book *Guns, Germs, and Steel*. Ever surprising, Dartnell juxtaposes facts as different as the sources of stone for the pyramids and the natural geographic divisions that separate Eastern Orthodox, Roman Catholic and Protestant Christianity.

"Only an acquaintance with Earth science allows people to understand the risk in where they build their houses."

This engaging treatment holds a larger lesson. In public education, the planetary sciences (geology, geography, climatology and astronomy) usually take a back seat to the more reductionist aspects of chemistry, physics and biology — at least in the United States. Here, 'rocks for jocks' — Earth science — is often taught by the football coach, and populated by students who, it is thought, 'can't handle' the other sciences. All the sciences are important. But only an acquaintance with Earth science allows people to understand whether there is a risk in building their houses on the Russian River floodplain in California or an eroding cliff in Goa, India; how the sediment under a house might withstand a magnitude-8.0 earthquake; whether the aquifers in a valley's hills are sufficient to sustain a golf course; and whether its soils can support plant communities that won't turn into a fatal tinderbox during dry years of a climatic cycle. In our current geopolitical climate, this knowledge is more important than ever. ■

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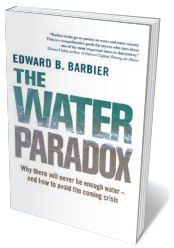
SUSTAINABILITY

The non-stop waste of water

Margaret Catley-Carlson reflects on millennia of resource mismanagement.

Every year, water shortages affect more than one-third of the world's population. In 2017, even Rome — ancient pioneer of urban water provision — saw its myriad public drinking fountains switched off. Environmental economist Edward Barbier plunges deep into these and other stories from the fascinating, often fraught world of water management past and present in his scholarly but accessible study *The Water Paradox*. Barbier investigates, too, the threats looming over water resources.

The paradox is this: despite ample scientific evidence on exploitation and overuse of fresh water, and ample wealth, knowledge and institutional power, humanity has created a preventable water crisis. We persist in exploiting fresh water as if it were abundant, even as we recognize its scarcity. By 2040, 2 billion people will be affected by the global groundwater crisis (more water being withdrawn than is refilling aquifers); Indonesia, Iran and South Africa will be among the countries suffering from high or extreme water stress.



The Water Paradox: Overcoming the Global Crisis in Water Management
EDWARD B. BARBIER
Yale University Press (2019)

The pressure will be environmental and agricultural, and will intensify social and economic crises.

If a good slice of our world falls apart because we cannot implement change, it will not be because we lacked historical warnings. Societies, city states and regions have collapsed into rubble or dry leaves because of environmental mismanagement. It could happen again.

To understand how, Barbier delves into millennia of misuse. He surveys irrigation and agricultural practices in the ancient Middle East, China, Europe and beyond, citing the 'hydraulic hypothesis' of early-twentieth-century historian

MORGANA WINGARD/GETTY

Residents of Cape Town, South Africa, queue to refill bottles during a 2018 water shortage.