Glop. Mire. Ooze. Cohesive sediment. Call it what you want, mud—a mixture of fine sediment and water—is one of the most common and consequential substances on Earth. Not quite a solid, not quite a liquid, mud coats the bottoms of our lakes, rivers, and seas. It helps form massive floodplains, river deltas, and tidal flats that store vast quantities of carbon and nutrients, and support vibrant communities of people, flora, and fauna. But mud is also a killer: Mudslides bury thousands of people each year.

Earth has been a muddy planet for 4 billion years, ever since water became abundant. But how it forms and moves have changed dramatically. About 500 million years ago, the arrival of land plants boosted the breakdown of rock into fine particles, slowed runoff, and stabilized sediments, enabling thick layers of mud to pile up in river valleys. Tectonic shifts that gave rise to mountains, as well as climate changes that enhanced precipitation, accelerated erosion, and helped blanket sea floors with mud hundreds of meters thick. Over time, many mud deposits hardened into mudrock, the most abundant rock in the geologic record, accounting for roughly half of all sedimentary formations.

Now, humans are a dominant force in the world of mud. Starting about 5000 years ago, erosion rates shot up in many parts of the world as our ancestors began to clear forests and plant crops. Even more sediment filled rivers and valleys, altering landscapes beyond recognition (see p. 898). In some places dams and dykes trapped that mud, preventing fresh sediment from nourishing floodplains, deltas, and tidal flats and causing them to shrink (see p. 896). And industrial processes began to produce massive quantities of new forms of mud—mine and factory waste—that is laden with toxic compounds and often stored behind dams that can fail, unleashing deadly torrents (see pp. 906, 910).

Despite its ubiquity, mud still harbors mysteries. Biologists, for example, are just beginning to grasp the vast menagerie of organisms that live in mud, and unravel the remarkable adaptations that allow them to cope with special challenges, such as a lack of oxygen (see p. 902). And biogeochemists are still grappling with the immense role mud plays in cycling carbon, and hence influencing global climate. Such issues, as the cliché goes, are still just clear as mud.