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On the rocks

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New research explains why a cancer-causing form of chromium has been turning up in ground and surface waters far from industrial sources.

Chrome plating and dye manufacturing are among the industries that generate chromium (VI), a form that the element assumes in certain compounds. But recently, researchers have discovered the toxic agent in regions—including California and parts of Mexico and Italy—beyond the reach of industrial contamination.

In these cases, "it was obvious that [chromium (VI)] had to be coming from a natural material," says Scott Fendorf, an environmental chemist at Stanford University.

Fendorf and his coworkers focused on the mineral chromite, found in certain rocks and soils common to the Pacific coasts and other seismically active areas. Over time, chromite slowly releases chromium (III), a relatively benign form of the element.

The researchers reacted chromite with birnessite, a manganese-containing mineral that often forms in weathered rocks and soils containing chromite. In water, powders of the two solids produced chromium (VI). "Both minerals tend to be fairly insoluble, but they dissolved just enough" to react, says Fendorf.

The researchers conclude that within 100 days, chromite and birnessite could generate chromium (VI) at concentrations above the World Health Organization's limit for drinking water—which is 50 micrograms per liter. In acidic conditions, such concentrations could be reached in fewer than 10 days, the team reports in the April 17 *Proceedings of the National Academy of Sciences*.

The work indicates that certain chromite-rich regions are at high risk for natural chromium (VI) generation. "You need to watch the groundwater pretty closely in these areas," Fendorf says.

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