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Through the lens of the Romans' world view, Mary Soderstrom considers the menace and promise of concrete, the material that made the world as we know it. The Romans perfected a kind of concrete that sets in water and has stood the test of time. Many of their constructions like Rome's Pantheon are still strong and wonderful today, but their knowledge was lost for more than a millennium. When new formulations were perfected in the 19th century the stage was set for the use of concrete to build housing, dams, water systems, power plants, roads, bomb shelters--in short the modern world.

This massive use of concrete has also contributed mightily to climate change in three ways. The first two are linked to the production of cement, concrete's major ingredient. Limestone is the cement's basic material. It is rich in calcium carbonate (a compound that has one calcium atom, one carbon atom, and three oxygen atoms) and when it is heated to very high temperatures, the bonds holding molecules together are loosened.

In the process, much CO₂ is released, both by the chemical process and by the fuel used in the huge kilns where the limestone is calcined. In fact for every 1000 kilograms of cement produced, 927 kg of CO₂ is released into the air. Since we use such a huge amount of cement, the process accounts for something between 5 and 8 per cent of the CO₂ emissions each year.

The way of life that concrete makes possible is responsible for another huge amount of green house gases. New buildings and new roads mean more green house gases, and a way of life that we are going to have to rethink if we want to do anything about climate change.

But why use the Romans' universe composed of four elements--Earth, Fire, Water and Air--as a way to organize a book about modern concrete? Because rather than write a simple history organized chronologically or a technical treatise, Soderstrom wanted a framework that would be both engaging and a reminder that our current methods are not the be-all and end-all. Each element also goes into making concrete, and concrete is essential to their modern use.

Earth is where all the raw materials for concrete come from. There's good reason why contractors and engineers sometimes call it "mud." Furthermore, the story of the various, sometimes slap-dash experiments leading up to modern concrete frequently resemble a how-to journal for making mud pies.

Fire is linked to concrete in several ways. First, fire is essential for its manufacture, and secondly concrete has been and is intimately connected to war. But also, for the last century concrete has been used all over the world to build millions upon millions of dwellings that range from do-it-yourself hovels to luxury apartment towers where our home fires burn, literally or metaphorically.

As for water, concrete is composed of up of about 30 per cent water, while the material is essential for producing the pipes, canals, dams that make water available for our use. Try to imagine a world without hydroelectricity, or drinking water piped long distances, or crops irrigated by water flowing hundreds of kilometres through concrete canals, and you get the connection.

Lastly, concrete has two important connections with air. The first is as tangible, physical, and measurable: the effects on the planet's atmosphere of making and using concrete. The second is metaphoric, and follows from the fact that the human spirit sometimes seems as insubstantial as air: it is what concrete, that wonderful, surprising material, can call forth from our souls.

Flash forward a couple of millennia from Roman times and several questions arise, among them, what is the future of concrete? Will the Covid-19 pandemic with its clear, lock-downed skies have any effect on concrete's use or its impact on climate change?

These questions must be considered in any plan for post-Covid recovery. In much of North America, many people who can are attempting to leave urban areas. If we are not careful, this could have an immense impact on our green house gas emissions directly and indirectly as new roads, housing and infrastructure is built. In China, where as much

cement was used between 2010 and 2013 as was used in the entire 20th century in the US, it was back to business as usual by the Fall of 2020.

Concrete: From Ancient Origins to a Problematic Future does not offer ready-made answers to these questions, but invites informed decision-making on the part of all segments of society from governments and industry to the choices that individuals make every day about the way they live.