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When Are We Going to Run Out of Metals?



Tim Worstall Former Contributor

Opinion

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Roger Pielke Jr, and The Economist are having a little discussion about whether metals prices are going to continue to fall, as they have done for the past century and a half. I'd like to sidle up to an answer to this question by answering first a slightly different one: are we ever going to run out of metals?

Or at least, on any conceivable time scale are we going to do so? I'll start with this because it's a common argument that we really are going to run out of "resources" such as metals at some point soon and it is this which is going to doom our industrial civilisation.

So, let us consider a minor metal which almost no one has ever heard of: tellurium. It's important because it's the major ingredient in Cd/Te solar panels, the sort of thing

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It's also very rare. The best guess is that the crust of the earth is only 0.001 parts per million (or one part per billion) Te. So there's really not much of it around. It is one of the very rarest elements on the planet in fact. And it would be a bit of a problem if one of our vital industries, solar panels to beat climate change, ran out of the vital raw ingredient.

So, how likely is this? Well, the Earth weights 6x10 to the 24 (sorry, can't do those clever math numbers) kilos, the crust is 2% of the Earth's weight and of that crust, one part per billion is tellurium which means that we've only got

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120,000,000

120 million tonnes of tellurium to play with.

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Given my maths it's entirely possible that there's too few or too many zeros there. However, current annual usage of tellurium is around the 125 tonnes a year mark. Yes, that is for the entire world, the global annual usage.

So, even for one of the rarest metals on the planet we seem to have a million year supply of it. We could, at this point, say that the environmentalists are obviously correct, there is a risk of running out and we'd better do something about it. But worrying about what happens in a million years time is really a very slightly silly thing to be worrying about: the odds that our species will still be here at that time are pretty low, let alone the idea that we'll be reliant upon Cd/Te solar panels.

So, no, we don't in fact face an actual shortage of atoms of the right elements. You're welcome to try the same calculations with any other element you choose and while you might come up with different time spans, the basic conclusion will be the same: we simply don't have a shortage of elements.

So, despite the silliness of this argument, to a first approximation we can say that no, we're not going to run out of metals. If I really, really, wanted some Te I could go out into my garden, dig up some soil and with enough effort I could get some Te. It would make more sense for me to go to the copper miner and ask him for his copper slimes (no, really, it's a good technical word) and process the Te out of those because the copper slimes have more Te in them than my garden does but it would still be possible, if expensive, to get it from the veg patch.

The same is also true of every other metal.

But of course what we really want to know is whether we will be able to get metals at the price we want to pay for them. To which the answer is a very differently reasoned "Of course, yes!". For this brings us to economics, not metallurgy or geology. If we want to use more metals than we can cheaply extract from the ores then the price will rise. A high enough price will mean that we don't want to use that metal anymore (we'll, for example, go and make our solar cells from silicon). So be definition we'll always have a supply of metals at the price we want to pay for them. They only become unavailable when the prices rises to where we don't want to use them.

And finally to the question that Pielke and The Economist are discussing: are metals going to continue declining in cost to us, even as the economy grows?

Yes, for two entirely unrelated reasons. The first is something I see in my day job (which is dealing with various weird and exotic metals): how much better we're getting, and how quickly we're doing so, at extracting metals from lower concentration ores. Over the past few months I've been working on a new supply of one metal and despite the way in which it doesn't really form ores, there's almost never a decent concentration of it, there are still several different ways of getting the amounts that people want to use. And those methods are getting ever better: quite serious people have been proposing genetic engineering of micro-organisms, sticking them into waste mine water (of which the world has no shortage at all) and getting them to concentrate out my desired metal. They claim to be able to do this with almost any metal as well.

One way of putting this is that we're getting better at mimicking the geological processes that led to the formation of ore bodies in the first place so to an extent we're creating our own economic concentrations rather than having to go prospecting for them.

The second point is that we now use hugely less of any specific metal to perform a specific task. Just in the last 40 years the gold plating on computer connectors has gone from 200 nm to 2 nm: we just need less gold to make computers now. Similarly, capacitors used to be 1 or 2 grammes of tantalum: they're now 20 or 30 milligrammes of the same material.

Now, the complex interactions of these technological trends on prices, no, I'm not willing to try and prognosticate in any great detail. Some metals prices will rise for some periods of time, others will fall. But as general outlines: we've no shortage of actual metals, just potential shortages of concentrations of them we are prepared to pay to dig up. And as we get better at the digging and use less to do any specific task anyway, my bet is that prices, over the long term, will continue to decline.

That isn't though, what we really care about. The "real" prices of metals just aren't important. What we really want to know is, what percentage of my income do I have to pay for the metals I use in my lifestyle? Another way of saying the same thing, how many hours do I have to work to get the metals I want?

And that's going to continue declining as it has ever since the very first stirrings of the Bronze Age because even if metals do get a little more expensive the general income is going to be going up much much more than those metals prices.

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Tim Worstall

I'm a Fellow at the Adam Smith Institute in London, a writer here and there on this and that and strangely, one of the global experts on the metal scandium, one of the r... [Read More](#)

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