

What's Wrong with Coal?

What is wrong with coal anyway? It sits passively in the ground, out of sight, causes no problems. Left like that it's perfectly benign.

by Arthur Caldicott

It's when someone wants to mine it that all hell breaks loose.

Let's go back 150 million years, back to the tail end of the Jurassic period (200-144 million years ago) and the early millennia of the Cretaceous (144-65 etc.). Atmospheric carbon levels were 1700-2000 parts per million, five times today's 380 ppm. Warm and humid, vegetation on steroids. Fast forward to the present, through the mass extinction event which marked the end of the Cretaceous and the beginning of the Tertiary period, through geologic upheavals, marine immersions, sediments, pressure, heat and time

Voila! 135 million years of plants, morphed into coal. Nature's incredible carbon sequestration scheme. What fools would undo it?

A coal layer cake

Coal forms in layers, or seams, separated by other inorganic substrates. Thick seams and extensive seams, are attractive for mining. Seams thicker than 10 metres, multiple overlaid seams, extending for kilometres, and higher rank coals – these are the coal miner's mother lodes. This describes the metallurgical mines in the East Kootenay but not deposits on Vancouver Island, for example, where thin, discontinuous, and lower grade coal is more common.

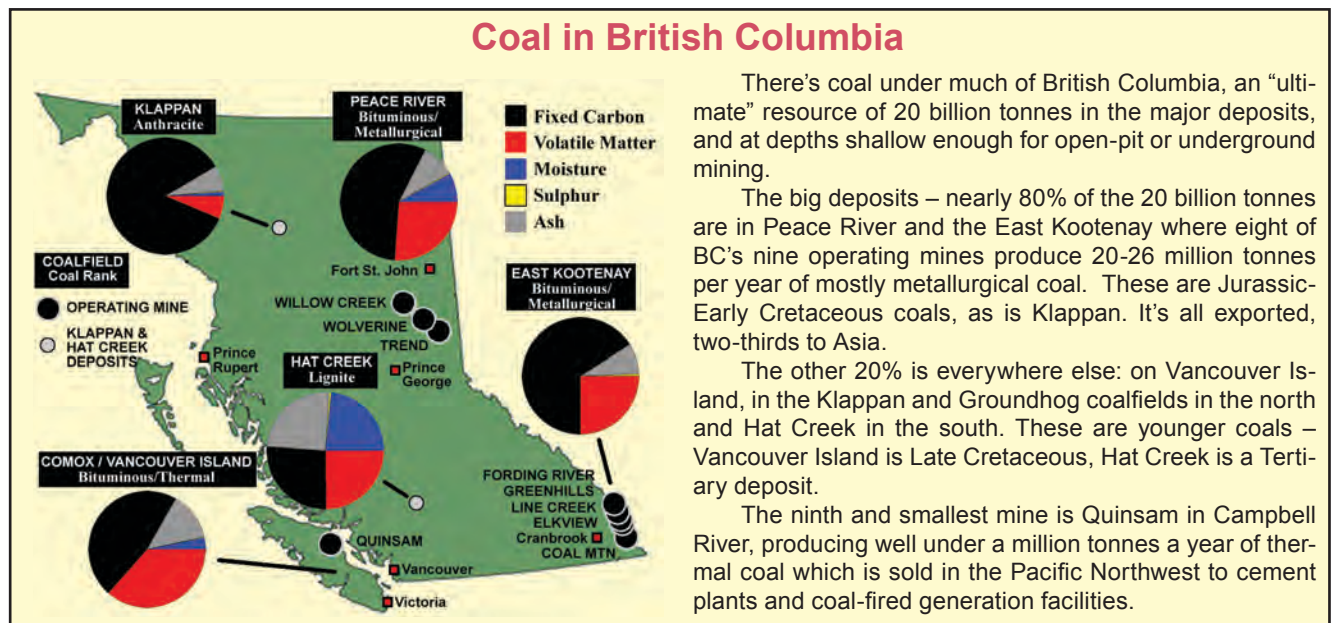
The main components in coal

Carbon, the primary substance in coal, is what makes it economically desirable. In BC's coals, fixed carbon comprises from 27% to an impressive 85% of the coal. The more carbon, the more valuable the coal. Air-dried anthracite from the Klappan coalfield is over 85% fixed carbon – the diamond of coals.

Volatile Matter also contains carbon, as carbon monoxide, carbon dioxide (CO₂), and various hydrocarbons. Less is better. A high ratio of volatile matter means that the coal ignites at lower temperatures with messy emissions. It is used in coal-fired generation (thermal) plants but is useless for steel-making (metallurgical) processes where very high temperatures and “clean” combustion are required. Volatile matter ranges from 8% to nearly 40% of BC's coals.

Ash is made up of inorganic substances, up to perhaps 25%. In thermal coals, it is useless bulk and ends up in slag as well as in airborne emissions. Small amounts of ash play an essential interim role in coke, used in steel-making, but too much ash and it's back to the thermal pile. All ash ultimately ends up as waste, and includes many toxic substances.

Moisture is quite variable. Less is better. Hat Creek lignite is 25% moisture.



There's coal under much of British Columbia, an “ultimate” resource of 20 billion tonnes in the major deposits, and at depths shallow enough for open-pit or underground mining.

The big deposits – nearly 80% of the 20 billion tonnes are in Peace River and the East Kootenay where eight of BC's nine operating mines produce 20-26 million tonnes per year of mostly metallurgical coal. These are Jurassic-Early Cretaceous coals, as is Klappan. It's all exported, two-thirds to Asia.

The other 20% is everywhere else: on Vancouver Island, in the Klappan and Groundhog coalfields in the north and Hat Creek in the south. These are younger coals – Vancouver Island is Late Cretaceous, Hat Creek is a Tertiary deposit.

The ninth and smallest mine is Quinsam in Campbell River, producing well under a million tonnes a year of thermal coal which is sold in the Pacific Northwest to cement plants and coal-fired generation facilities.

Sulphur is always a negative. Uncontrolled emissions from sulphurous coal have caused high levels of acid deposition around the world. Some sulphur is removed in the wash at the mine site, other sulphur is removed from emissions during combustion. The pyritic sulphides in which sulphur and trace metals are found are acid generating, and usually toxic when released.

Mining and processing coal

Coal is mined from both underground and giant open-pit operations, which rival the tar sands for footprint. (Sentinel Hotspots, <http://sentinelhotspots.ca>, Line Creek Operations, and zoom in.)

In the common “room and pillar” method, remotely operated “continuous miners” dig into the coal seam, leaving sections of coal in place to support the roof. Once the furthest extent of the zone has been reached, the mining machine begins removing the pillars, as it retreats from the worked area.

At the surface, the run-of-mine coal is moved to a preparation plant where a sequence of mechanical processes break the coal to a standardized particle size, remove unwanted rock and other adhering material, and clean the coal as much as possible of ash and sulphur. Cyclones, centrifuges, heavy-medium baths are employed. The heavy medium is a solution of water and magnetite, in which coal floats and heavier rejects sink.

What remains is “clean coal,” ready to ship to market. Often, over half of the run-of-mine material stays behind as waste. Wet wastes are directed to settling ponds, and dry wastes are moved to reject piles. These wastes and waste storage schemes are the source of most mining pollution.

Canaries and climate change

The most volatile hydrocarbon in coal is methane. Once coal is removed from the surrounding substrates and the groundwater in which it is immersed, methane gas immediately starts to “desorb” from the coal. Methane is highly explosive and is the reason that canaries were introduced to coal mines – the birds would succumb to the methane before the miners would otherwise be aware of its presence.

Canaries have been mercifully replaced by improved detection and ventilation technologies, but the problems with methane remain. It continues to desorb from coal long after it has left the mine, so the risk of explosion exists wherever coal is stored, especially in contained places. The most common method of dealing with desorbing methane is to vent it into the air. With 72 times the greenhouse effect of CO₂ over twenty years, this “liberated methane” is consequently the fourth largest anthropomorphic source of methane.

The toxins

Water is inevitably affected by a coal mining operation. Huge volumes of water are moved around – removed from the mine, used in washing coal, run off into wet reject ponds. All of it eventually ends up back in the receiving environment changing ambient baseline levels of particulate matter, nitrogen, phosphorus, oxygen, and pH. Harm to fish, to other aquatic and riparian biota, and to domestic water, are all likely consequences of a coal mine.

A breathtaking list of trace metals and non-metals may be concentrated and released. It includes (deep breath) aluminum, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, fluorine, iron, lead, manganese, mercury, nickel, selenium, silver, strontium, thallium, vanadium, and zinc (gasp!).

If we got the toxins thing under control, then there’d be no problem?

Wrong. Coal used in electricity generation and steel-making is humanity’s largest source of atmospheric carbon, and the leading cause of climate change. Coal mining and handling is also the source of enormous methane releases.

The climate crisis is getting worse. The failure of governments to achieve a meaningful agreement in Copenhagen underscores the prevailing political paralysis. Coal producing and coal consuming nations must both stop the coal train, literally and figuratively.

When a million tonnes of carbon is burned, about 3.6 million tonnes of CO₂ is released. Coal isn’t all carbon, of course, but virtually all the carbon in coal ends up in the atmosphere. Add to this the liberated methane and the CO₂ emissions created in the production, transportation, and processing of coal. A three times factor is an imprecise but useful rule of thumb. BC’s production of 26 million tonnes of coal, then, results in 78 million tonnes of atmospheric carbon. The government doesn’t include any of it in its inventory of provincial greenhouse gas emissions.

We started with the wrong question. There is nothing wrong with coal that leaving it in the ground won’t fix. To paraphrase Pogo, “We have met the fool, and he is us.”



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