



RESOURCE BLINDNESS IN YOUNG PEOPLE AS EXEMPLIFIED IN THE UNITED KINGDOM – ANOTHER REASON WHY WE NEED TO TEACH GEOLOGY.

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Article Info

Article received August 2016
Accepted November 2016
Published December 2016

Keywords:

Geo-education,
Blindness resources,
Teaching in UK.

Abstract

Young people in the United Kingdom often do not appreciate the geological origins of the advanced the materials used in their technology and clothing or how dependent they are on fossil fuels. This results in a failure to appreciate the extent of their lifestyles environmental impact. We as educators need to ensure they understand the origin, distribution of the geological resources they are using along with the extraction methods used so they are able to make environmentally informed lifestyle choices.

Introduction

In today's post-industrial United Kingdom we are removed from the sources of much of the materials we use to facilitate our everyday lives. The availability of complex technology such as those used in computer manufacture, advanced materials and textiles for much of our clothing as well as less exotic materials such as those used in construction are taken for granted. An understanding of the origin of the material is not necessary for us to embrace the advantages of modern technology. As the feedstock for the majority of these products needs to be dug from the Earth by whatever means is suitable, their sourcing will have

environmental implications and consequences which may be on the other side of the world but are the responsibility, at least in part, of the buyer/user. If we are going to achieve a realistic understanding of the environmental impact we are responsible for on both an individual and societal basis then an understanding of where and how the materials we so easily take for granted are sourced becomes a necessity.

Mobile phones, ubiquitous in modern society, are made of plastic, various metals and use a variety of exotic elements in the complex components. When asked about the origins of the material used to manufacture smart phone components few of my undergraduate geology

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students seemed aware that most plastic is made from oil. A few were aware of the use of rare earth elements in the magnets of the speakers but could not give a geological explanation of the origins of these highly sought after resources. The environmental impact of the mining and processing of rare earth elements has been well documented (e.g. [1] [2]). Even more alarming than the direct environmental impact of extraction and smelting is the financing of armed conflict in parts of Africa. The mining of tin, tantalum, and tungsten in the Democratic Republic of Congo for use in consumer electronic devices has financed the deadliest conflict since World War II along with horrific abuse of the local populace [3](Kean 2011 95-97). If we are to equip our young people to deal with the consequences of our love affair with technology then understanding the origins of the materials we are using is surely a good first step.

One reason for the lack of understanding of the origins of materials we use and take for granted in our daily lives is globalisation. When I was young living in northern England in the 1970s coal mining was a visible industry with several mines operating in the local area. The coal industry was pivotal to the national economy and mining community was also politically active so the industry had a high media profile. With the demise of the industry since the 1980s (the last deep mine in the UK closing in December 2015) coal has become invisible despite 37.8 million tonnes being consumed in 2015, 25.5 million tons of which were imported, generating 23% of the UK's electricity [4]. The majority of this coal coming from Russia (45%), Columbia (26%) and the USA (22%) [5]. The former coal mining areas of the UK are dotted with monuments to this once mighty industry some of which detail the appalling cost in human lives even in relatively recent times. The memorial at Allerton Bywater in West Yorkshire for example names every miner killed in the lifetime of the mine averaging one life a year (Figure 1). People still work in hazardous environments every day to provide the coal we use but now they are not regulated by UK health and safety legislation and are so far away we are unlikely to hear of anything except major incidents. Even with a recent revival in popularity of solid fuel stoves over the last

decade many of my undergraduates have not seen or touched coal until they see it in hand specimen as part of their first year geological materials practical classes. With the country wide switch to natural gas in the 1970s as gas was discovered under the North Sea, as opposed to gas generated from coal at a locally based gas works, our houses are warmed with no obvious burning of hydrocarbons (Figure 2). This lack of familiarity with fossil fuels, still our main energy source, was highlighted by questions from year 6 pupils showing they were confusing information about fossil fuels with cooking oil (Murphy 2015).

Where active mining does take place in Britain it often goes to great lengths to hide its visual and environmental impact so people are unaware that large scale extraction does still take place. The UK extractive industry produced 210 million tonnes and had a turnover of £15 billion in 2013 [6]. Part of the planning for a new mine near Scarborough in North Yorkshire, northern England, is specifically to limit its visual impact [7]. When was a child on the seemingly never ending drive with my family to see my grandparents (actually only 80 miles) we passed quarries where trucks could be seen being loaded with crushed stone and lime kilns were working beside the main road. All this is now hidden behind landscaping but is still going on.

While everyone knows the petrol and diesel we use in our cars are fossil fuels a lack of understanding that plastic is a product of the oil industry appears to be very common. I was recently subject to a series of disparaging comments about my personal environmental impact from a colleague, presumably triggered by my role in training geologists who work in the hydrocarbons industry. The idea that anyone working in any capacity for the hydrocarbons industry is a profligate user of oil and gas is something I see and hear often but my personal experience is those who have witnessed the complicated and risky business of drilling for oil tend to be very aware of their carbon footprint and actively try to reduce their hydrocarbon use. My colleague was wearing a waterproof coat and waterproof boots. I can only presume she was not aware both items are made from materials originally sourced from oil. Packaging in the UK, especially food packaging, is a major use of fossil fuel feed stock. My local supermarket sells

individual bananas on a polystyrene tray covered in cling film both of which are sourced from petrochemicals, chemical products derived from the distillation of petroleum, and both surely unnecessary for a fruit with its own natural, robust packaging.

This lack of understanding as to what and where items we take for granted as part of our lives are sourced from, what I am calling resource blindness, is something we need to deal with in order to be able to make informed decisions about future energy use and other complex issues with environmental impact. When talking to people struggling to understand the complex arguments around the possible use of hydraulic fracturing (fracking) [7] I often find it is routine oil industry practices which they are most concerned about having looked for the first time in detail as to where the petrol they put in their car comes from. The risk of casing (the metal lining of the well) failure for example is present in every oil well – not just those targeting unconventional hydrocarbon using hydraulic fracturing. While the spectacular blow out from Deepwater Horizon in the Gulf of Mexico during 2010 received worldwide coverage [8] accidents have happened closer to home such as an oil field fire in 1984 which brought the famous Texan oil field fire fighter Boots Hansen to northern England (Nield 1985).

It is 100 years since the first successful oil well was drilled in the UK at Hardstoft in Derbyshire, Northern England (Craig *et al.* 2016). Since then hydrocarbons as an energy source and materials feedstock has reached into every aspect of our lives but many of us are now increasingly separated from the extractive industries which feed our desire for new and more complex consumer goods. We face increasingly complex decisions regarding the future sources of energy and their environmental impact dealing with this lack of understanding of what we use and where is vital to being able to make a truly informed decision. An understanding of the geological origins, how the resources we use are formed and where they occur, is I believe a necessary first step in ensuring our young people are equipped with the knowledge required to make the correct decisions regarding our future energy use, materials consumption and geopolitical issues on

both a local and global scale. As people in other areas of the world become similarly detached from the source of the energy, clothing, packaging and technology they use it is up to us as science educators to equip them with the knowledge to be able to make environmentally informed decisions to try and limit their resource use.



Figure 1. The memorial to miners killed at work over the 100 year lifetime of Allerton Bywater coal mine, West Yorkshire, England.



Figure 2. A modern water heating system installed in a typical UK household (the authors house). It shows very little evidence that fossil fuel is being burned inside this metal box which itself is hidden away in a cupboard.

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[2]http://e360.yale.edu/feature/boom_in_mining_rare_earths_poses_mounting_toxic_risks/2614/

[3]<http://www.ethicalconsumer.org/ethicalreports/mobilesreport/conflictminerals.aspx>

[4] <http://www.coalimp.org.uk/3.html>

[5]<http://www.greenpeace.org.uk/newsdesk/energy/data/decc-data-five-charts-how-uks-renewable-power-rising-while-fossil-fuel-output-falls>

[6]http://www.mineralproducts.org/documents/CBI_UK_Mineral_Extraction_Industry_2016_2.pdf

[7]<http://www.siriusminerals.com/our-project/mine-and-mineral-transport/>

[8]<https://www.gov.uk/government/publications/about-shale-gas-and-hydraulic-fracturing-fracking/developing-shale-oil-and-gas-in-the-uk>

[9]http://ccrm.berkeley.edu/pdfs_papers/bea_pdfs/dhsgfinalreport-march2011-tag.pdf

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