

Thème 1 – La Terre dans l'Univers, la Vie, l'évolution du vivant  
1B - Le domaine continental et sa dynamique

Smartphones for ever?

Present the rare earth elements or REEs (formation, mining, extraction, use...) then discuss the new process of extraction presented in document 2 on a sustainable and eco-friendly level.

**Document 1: The Geology of Rare Earth Elements**

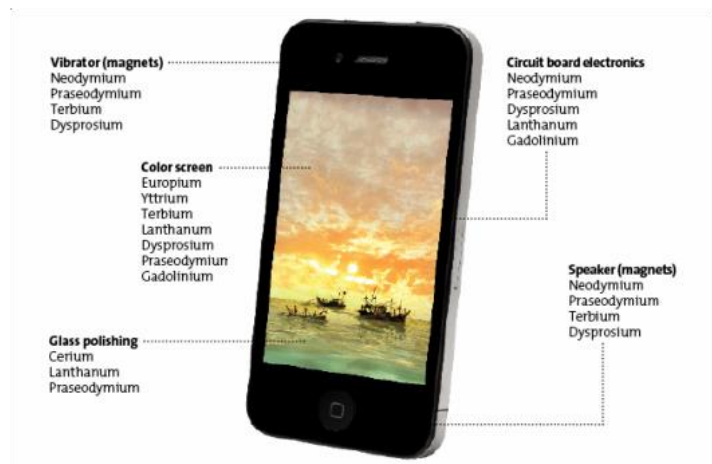
Alkaline igneous rocks form from cooling of magmas derived by small degrees of partial melting of rocks in the Earth's mantle. The formation of alkaline rocks is complex and not fully understood but can be thought of as a geologic process that extracts and concentrates those elements that do not fit into the structure of the common rock-forming minerals.

- 5 The resulting alkaline magmas are rare and unusually enriched in elements such as zirconium, niobium, strontium, barium, lithium, and the rare earth elements (REEs). When these magmas ascend into the Earth's crust, their chemical composition undergoes further changes in response to variations in pressure, temperature, and composition of surrounding rocks. The result is an astonishing diversity of rock types that are variably enriched in economic elements, including the rare earth elements.

Source: <https://geology.com/usgs/ree-geology/>

**Document 2: What do we need to build up a smartphone? What environmental cost?**

5 The truth is that the fundamental material your smartphone is made of probably came from one mine in China. The Bayan Obo mine produces more than 95% of the world's REE; the uniquely multivalent metals that make your phone 'smart'. Lanthanum, for example, gives smartphone screens their smoothness and colour pop; neodymium's super-high magnetism puts microphones, speakers and vibration units all in the palm of our hands.



Source : <http://web.mit.edu/12.000/www/m2016/finalwebsite/problems/limitedaccess.html>

5 Extracting REEs from ore\* – as companies do in China – involves poisonous and radioactive acid baths; so finding soil and clay\* deposits to extract from instead is a huge step towards better public and environmental health. “One thing we don’t do very well is recycling REEs from redundant\* technology. As the amounts used in any individual gadget are tiny, it’s considered uneconomic. But maybe this will change.” Ironically, the potential of the remote sensing technology may actually harm the possibility of recycling old devices for REEs in the future. If new mines were prospected and developed, the market value of REEs would inevitably be reduced, giving little incentive for companies in the West to spend more  
10 money on recycling.

“Rare earth elements aren’t in short supply, particularly if we start exploiting the sea floor – but that opens a new environmental can of worms.”

Source: <http://www.bbc.com/future/story/20171024-an-eco-friendly-way-to-make-smartphones>

\*ore: a naturally occurring mineral containing a valuable constituent (such as metal) for which it is mined and worked

\*clay: earthy material

\*redundant technology: no longer needed smartphones, *etc.*

\*a new environmental can of worms: a new environmental problem or debate