Who needs geoscientists? Career options in a time of energy transition

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Historically, many geoscientists have been employed in searching for and extracting resources, either hydrocarbons, minerals, or water. Concerns about the environmental sustainability of geological vocations appear to be reducing the number of students studying geoscience, at least in many developed western nations. What then are the options for those wishing to pursue a career in geology? The need for geoscientists is paramount in a time of energy transition, be that in traditional spheres of employment or in what may be termed “sustainable geoscience,” although these are not mutually exclusive. Growing global population and economic growth are likely to drive an ongoing rise in energy demand as the century progresses. Despite the growth in renewables, the energy mix for the next few decades is likely to continue to include a significant contribution from natural gas, oil, and, to a lesser extent, coal. The challenge is to be as efficient as possible in the exploration for these resources and to locate those with the lowest carbon footprint created by their exploitation (“green oil”). This means a focus on reservoir geology so that well placements and trajectories are optimized. These skills will also allow geoscientists to contribute to solutions that may help achieve carbon neutrality targets. Carbon capture and sequestration (CCS) is likely to grow in importance and requires geoscientists who can model subsurface repositories and the behaviour of fluids injected into those repositories. Other avenues exist in engineering geology in relation to the challenges of installing new wind farms and for the construction of measures to mitigate the impacts of climate change that are already inevitable. A growing number of geologists are engaged in investigating the potential of geothermal energy. The global improvement of living standards and society’s ongoing appetite for technology places a demand on the supply of raw materials (e.g., copper and rare earth elements) that could quickly outpace our known reserves. Geoscientists are needed to locate new deposits, including those in the oceans. As the global population continues to expand towards 11 billion people, water supply is likely to be one of the major challenges society faces as the century progresses. Hydrogeologists are needed to locate and manage aquifers as climate evolves and to protect them from pollutants. Academic geologists can provide support to all of these industrial activities, but there is also much fundamental research to be carried out. It is now over 50 years since the advent of the last major paradigm shift in geoscience – plate tectonics – another is surely overdue. We still have much to learn about processes operating in and on Earth today and in the past, and the evolution of life. Holistic Earth systems science approaches can be useful, for example, by using the past to model climate evolution. One exciting avenue is the impact of the digital revolution on geoscience. Data science is providing new scientific insights and is transforming all resource industries, contributing to efficiency and associated environmental benefits. The future geoscientist needs to be technology and data science literate, but with an underpinning of sound geoscience knowledge. We do not know where this exciting phase of technology and data science change will take geoscience, but it is clear that geoscientists will be needed to support society as it enters a period of unprecedented change.