Biostratigraphy and the energy transition

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The ongoing energy transition means that the subsurface has never been more in demand than it is today. In addition to selective exploration for and exploitation of traditional resources, subsurface understanding is required to store CO_2 and hydrogen, to locate critical minerals, for geothermal energy, and for engineering projects including wind turbine location. Geoscientists are therefore required to predict and characterize the subsurface. This in turn requires an ability to correlate rock units and determine their depositional setting to build the most plausible subsurface models possible. Chronostratigraphically significant correlation and paleoenvironmental interpretation are the long-established strengths of biostratigraphy, especially when integrated with techniques such as sedimentology, sequence stratigraphy, isotope stratigraphy, and geophysics. Such applied biostratigraphy may be carried out as part of desktop studies or during operations, such as the drilling of a well.

Successful applied biostratigraphy is rooted in the detailed understanding of the fossils involved, including the agreed identity of taxa (through taxonomic studies) and an understanding of stratigraphic ranges that ideally are calibrated to the standard chronostratigraphic scale. Bioevents (e.g., the inception and extinction of taxa) can be recognized, placed in order, and biozonation schemes developed, defined by these events and characterized by assemblages of taxa. To some, this may seem old-fashioned science, but it remains essential. Misuse of taxonomic names and poor age calibration can lead to uncertain stratigraphic or paleoenvironmental ranges, diluting the power of the fossils involved. Calibration of Turonian nannofossil bioevents and biozonation schemes is a case in point, and despite decades of research, agreement on the identity of the fossils and their ranges remains to be achieved. It may be that digital techniques such as machine learning will prove useful in the quest for improvement in biostratigraphic understanding by accelerating identification and interpretation procedures, but their success depends on a major effort of standardization in understanding identity and range. In short, the time of the "stratigraphic atlas" of a particular fossil group has not yet passed!

It is essential that the value of applied biostratigraphy in the energy transition is understood, and not just by biostratigraphers, but by the geoscience community in general. Successful case studies and best practices need to be shared. Moreover, a new generation of applied biostratigraphers is required to answer the subsurface challenges of the energy transition. Provision of energy with minimal environmental impact is the greatest challenge humanity faces in the 21st century if health, prosperity, and societal stability are to be maintained. This requires a major upgrade in the understanding of the subsurface that is supported by all aspects of geoscience, not least of which is biostratigraphy.