COMMENTARY

Reginald Aldworth Daly on 'much data, but little thinking'

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In the 13 Sept. 2021 issue of *Nature* (v. 597, p. 305), Paul Nurse published a very timely warning for biologists titled "Biology must generate ideas as well as data" with the subtitle "Data should be a means to knowledge, not an end in themselves." When I read it, it reminded me of a piece published more than a century ago by the great Canadian geologist Reginald Aldworth Daly (1871–1957) in the introduction to his *Igneous Rocks and Their Origin* (1914, p. xxii):

> What geology, like every other science, needs to-day is a frank recognition that imaginative thought is not dangerous to science but is the life blood of science. Even the universities do not fully recognize this fact and are notoriously failing to develop the stimuli which are necessary for the controlled, scientific imagination. Not only is geology now characterized by rigorous thought; by its nature as a science involving long excursions into space—inaccessible places—and time—epochs long passed—geology is peculiarly fitted to stimulate the regulated imagination, a process at the core of the highest education. Science is built on a long succession of mistakes. Their recognition has meant progress. Progress, indefinitely more rapid, will be possible when men of science have more generally lost the fear of making mistakes in using to the uttermost their powers of correlation and deduction. Science is drowning in facts. It can only be rescued by the growth of systems of thought. Better than none are "little systems" that "have their day and cease to be." We can hope that geology, like every other science, will find its superman who shall show us the building hidden behind the scaffolding of myriad isolated facts of nature. Meantime, it is the duty of every worker in science to strive for a complete mental system in his field of research and, however mistaken he may be, he should have the special sympathy of fellows. The best sympathy is expressed in constructive criticism. The "facts" of to-day are the hypotheses of yesterday.

In a paper published in 2014 in *Geodinamica Acta* titled "Outcrops, Isotopic Ages, Terranes and the Undesirable Fate of Tectonic Interpretations" (https://doi.org/10.1080/09853111.2013.858953), I had complained about the same problem of "much data, little thought." The superman Daly was hoping for in geology did come from among his countrymen, when J. Tuzo Wilson (1908–1993) invented the theory of plate tectonics in 1965. It was followed by three decades of superb research in geology, but then geology sank back into its parochial nature, dominated by a craze of data collecting mostly without good theories; that activity added much to our knowledge, but not much to our understanding of the structure and the history of our planet. This reminds me of the episode in the twentieth century, which I called elsewhere "the Dark Intermezzo" between 1924, when the great genius Émile Argand (1880–1940), the only true heir to Suess, withdrew from geology and 1965 when Wilson put forward the theory of plate tectonics.

I think all geologists should read Daly's wise words from more than a century ago and contemplate what went wrong. I think we should ponder whether our education system in geology needs a reform. Let me end with a quotation from Charles Darwin:

"I am a firm believer, that without speculation there is no good & original observation" (Darwin to Wallace, 22nd Dec. 1857; see Burkhardt and Smith, editors, 1990, *The Correspondence of Charles Darwin*. Volume 6: 1856–1857: Cambridge, Cambridge University Press, 1990, p. 35).

FURTHER READING

Şengör, A.M.C., 2019, Observations: what for?: Canadian Journal of Earth Sciences, v. 56, p. xi–xiv.