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Scientific Thinking in *Laura, voyage dans le cristal*

In *Laura, voyage dans le cristal,* George Sand initiates a literary and scientific dialogue on a story that reflects her own scientific knowledge. A voyage is conceived following a clumsy error made by Alexis when he drops a geode. A very cold Alexis finds himself with a very ethereal Laura at the north pole surrounded by icebergs and glaciers. Igneous rock is hardened by age and pressure, and contains virtually no water due to condensation and since the ice crystals (*krys*) have the same geometric form and also lack water, one is led to assume that this dry, cold northern landscape is extremely ancient. Since every action has an equal and opposite reaction, the result of the fumble was his appearance into this very challenging climate. The interweaving of tactile (the geode) and abstract (moral consequences of error) elements allow the fantastic to enter into the story. What was simply a brilliant gem with all of its artificial « parure » becomes a dangerous portal into a world of cold space and long time, and the reader feels as does a student upon first opening a textbook on crystallography, geology or other sciences.

There is evidence in the novel that Sand has studied science. Firstly, Sand defines crystallisation as « l'action par laquelle des molécules intégrantes d'un minéral se réunissent après avoir été dissoutes dans un fluide » (91). Secondly, she correctly describes the molecular structures of igneous rock such as mica, feldspar and quartz and crystals such as diamonds as « obélisques réguliers ou entassés les uns sur les autres » (118), a characteristic discovered empirically by René Just Hauy in 1784. Thirdly, the mathematician, Fourier, theorized the dynamics of heat exchange (thermodynamics) by using mathematical derivatives (dy/dx) to show the temperature change observed in water as heat passed through it and some of the description in the novel is of warm temperatures in bodies of water that lie close to glaciers.

Sand may have borrowed Fourier's theory describing heat passing through an object to show how nature is constantly changing and evolving. At the pole, Alexis and uncle Nasias discover a warm lake bordered by trees amongst icey glaciers. Alexis, as an evolutionist, observes the warm lake and identifies it as pristine and primordial. The uncle, who has come to the north pole to find the diamond that exists at the earth's core, sees the warm lake and thinks immediately that the water would protect the diamond from any volcanic combustion. Its warmth, in his mind, would come from volcanic activity and he had reasoned *a priori* that he would find a current of water surrounding the diamond that he postulated is at the central axis of the earth. This water, he said, « (qui) tourne autour de l'axe terrestre » would be there due to « (q)uelque

cataclysme » (165), that is to say, the biblical flood. However, he had not predicted that it would be warm. The notion that geological structures are caused by catastrophes was typical of Neptunist theorists who believed changes in nature were due to giant upheavals such as volcanic action or floods. Evolutionists, such as Darwin, were positivists and worked through observation. They believed that change was more gradual and occurred on a smaller scale. Nasias wants to at least see the diamond but worries that he will drown in the water that he thinks will swirl in a centrifugal motion around the gem. Alexis explains that water also falls downwards (due to Newton's positivistic theory of gravity) and that therefore he would not be caught in a giant wave but only have to evade a cascading waterfall. Reassured, the uncle jumps into the icey caverns in pursuit of the jewel. The mystery of « des grottes mystérieuses » (8) within subterranian icey glaciers is thus solved by Alexis who sees them filled with cascading water. Sand, in turn, has cleverly substituted a small « pierre géodique » with an immense glacier within a microscopic world, by capitalizing on the similarity of their geometrical structure.

Sand is aware that two things that are similar or symetrical are not identical. Walter and Alexis are both courting Laura, however with his German background, Walter is aligned with Neptunist theories. As well, Walter is patriarchal and archaic, working in salons of the former nobility. Walter as a Neptunist and Alexis as an evolutionist represent a duality, the former using deductive reasoning from first principles, the latter using positivistic science with its inductive empirical reasoning. Laura chooses Alexis as a husband because of Walter's patriarchal personality and her choice takes place in the « salon » belonging to Uncle Tungstenius, named after the element tungsten, 'W', in the Periodic Table, a system based on 'la chimie nouvelle' greatly admired by Hauy. The story quickly ends its *mise-en-abyme* in returning to the narrating voice of M. Hartz.

Sand alludes to several dualities in the story, such as nobility/industry, plan/accident, inductive/deductive, hot/cold, particular/universal and eternal/finite, not evaluated as to moral superiority but instead treated sceptically as arbitrary. Laura's choice of a French husband over a German is arbitrary. Le *jardin des plantes* and its museums held cabinets displaying the names of species labelled in both languages, with France naturally preferring the French nomenclature over Werner's technical language. Sand understood the new science from a social point of view as cultures of nations gave it their own particular characteristics but also inspired an international sharing of ideas and knowledge. In a final comparison, Sand describes the love of science for its « exaltation intellectuelle » as observed in Alexis' « calme triomphal » (177), but after witnessing a new architecture composed of cristal prisms and waterfalls, different from anything previously experienced or to be seen, he and Laura begin a humble married life away from exaltation.

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