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'In from the Periphery'? Re-framing the Reach of the Nineteenth-Century French Literary-Scientific Imagination

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ABSTRACT

By investigating what it calls the literary-scientific imagination, this article refocuses critical attention towards new nineteenth-century French scientific knowledge in texts outside the realist 'canon'. Chateaubriand's *Atala* (1801) reveals French natural scientific nomenclatures illuminating significant, non-Western, knowledge. Scientific discovery in 'provincial' France proves discipline- and genre-defining in Adrien Cranile's little-studied *Solutré* (1872). Sand's fantastical-dystopian *Laura ou Voyage dans le Cristal* (1864) demonstrates important re-educational review of imperial scientific progress. The shared peripheral visions, *effets de l'irréel* and critical-creative scientific possibility of these indicative texts demonstrate the richness of the (nineteenth-century) French literary-scientific imagination for onward study.

KEYWORDS

Frame narrative; literary-scientific imagination; periphery; *préhistoire*

In the diverse worlds, subjects and genres of nineteenth-century French literary production, references and allusions abound – in local colour and exotica in Romantic and Symbolist poetry, in detailed, technical description in realist, naturalist and science fiction – to the many new ideas, methods and material discoveries of France's natural, geological and medical sciences. Their interest and rich intertextual 'effets de réel' thus added to nineteenth-century general and informed readers' enjoyment, education and curiosity, yet paradoxically elude, and may even deter, the modern internet-savvy reader. If this article therefore targets the pleasures of what I call the nineteenth-century literary-scientific imagination, and hence the critical knowledge gaps that are references and allusions to the multifarious worlds of nineteenth-century French scientific understanding in literary representation, my larger concern is both why such knowledge gaps matter, and how Dix-Neuviémistes can address them through the methodological cues of my title. The first is positional. To bring nineteenth-century French sciences as well as scientific allusions and intertexts 'in from the periphery' of literary criticism – and as we will discover specialist literary-critical introductions to canonical French texts – follows the trajectory of Beer's ground-breaking *Darwin's Plots* (1983) for English Studies, and for the impacts of Darwin on the 'open fields' (Beer 1996) of Victorian cultural studies and History of Science. Too few are

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studies such as Lyle and McCallum (2008) that start from the vantage point of France's sciences as central to its long nineteenth-century (literary) culture.

But the literary-scientific, even in realist-naturalist mode à la Balzac or Zola, is no less 'peripheral' in specialist Francophone history of nineteenth-century French science(s), as exemplified in research publications of the Muséum National d'Histoire Naturelle and Centre Alexandre Koyré. Their accounts of leading national scientists, first discoveries, institution and paradigm-shifting work(s) in various French scientific disciplines of the period exclude non-factual genres for science dissemination. By contrast and more importantly, the second cue of my title is therefore correlational. Feminist cultural historians of nineteenth-century sciences have been especially alert since the 1970s to the gaps, exclusions and alternative models in such grand narratives of (national) science production. Indicative is Sally Gregory Kohlstedt's 'In from the Periphery: American Women in Science, 1830–1880' (1978) revealing the provenance of my title quotation. By representing on the one hand the transnational incomer-founders of 'American' science (including Louis Agassiz), and on the other hand counter evidence for the alleged non-participations of women and other 'amateurs' within its national history of the sciences, the many overlooked protagonists in science discovery and *engagement* emerge more clearly. For Kohlstedt, priority status of the 'expert' science publication excludes and occludes 'popular science' writing as among the alternative outlets for women's work(s) at the forefronts of nineteenth-century sciences.

Kohlstedt's standpoint models for peripheries and gaps as re-centring spheres of influence and interest clearly enable important feminist, and other decolonializing, review that also critiques (Western European) metropolitan 'centres' of science and literature. The interdependency of centre-periphery coordinates, however, risks the reinstatement of hierarchies and authorities of knowledge of science as well as history of science (whether national or disciplinary), rather than their larger 'reframing'. This strategic term is the third methodological cue of my title. Expert Dix-Neuviémiste literary-scientific critique can attend to what a standpoint historian such as Kohlstedt cannot, namely the pivotal national and intercultural importance of the French language as international vernacular of science in the long nineteenth century (Wright 2006; Gordin 2015). The significance and circulation of French scientific vocabularies, ideas, theories and poetics (rhetoric) as formulated in works of 'expert' science is therefore also interwoven intra-culturally into French literatures. For Dix-Neuviémistes also cognizant of comparative Anglophone, Germanophone, etc. histories, literatures and sciences of the period, the field of the French literary-scientific imagination is thus very much more than the energetic recuperation of French/Francophone nineteenth-century literary texts for inclusion in the debates and corpora of predominantly Anglophone studies in contemporary environmental, medical and emergent blue humanities (Alaimo 2019; Attala 2019). Rather the impetus, reception and impacts of specific nineteenth-century *French* sciences and science-making as disseminated and rearticulated in cultural productions of the period are my more ambitious remit for the French literary-scientific imagination as transformational of both terms of this compound adjective once it is reframed in bifocal and dialogic, instead of 'periphery-centre', review.

My three case studies therefore differently promote the reach of the nineteenth-century French literary-scientific imagination as the fourth keyword of my title, to open its supposed 'canon' of largely realist, naturalist and science fiction to hybrid and

overtly non-realist genres – as exemplified in Flaubert’s *Tentation* (Orr 2008) – because these no less adroitly deploy scientific allusion and reference (intertextuality) by differently maximizing on *effets de l’irréel* to make salient scientific and literary points. In Chateaubriand’s *Atala* of 1801 (1989) the focus is first on referential detail pivoting on French natural scientific nomenclature and contexts that illuminate significant, non-Western, knowledge of the natural world in this well-known text. Second, investigation of the history of French scientific discovery specific to its provincial contexts proves to be discipline- and genre-defining in Adrien Cranile’s *Solutré, ou les Chasseurs de Rennes de la France Centrale: Histoire Préhistorique* (1872). That this text is so little known says much about the metropolitanism of nineteenth-century French scientific and well as literary canon formation. George Sand’s *Laura ou Voyage dans le Cristal* of 1864 (2007) then challenges through its fantastical-dystopian crystallization of professionalizing empirical science disciplines the re-educational remits of the French literary-scientific imagination, to question the larger authority, truth and beauty of the scientific imaginary in her tale. The peripheral visions and non-realist modes that these three case studies share thus identify in their common frame narratives, scientific (cross-)referencing and informed multi-contextual perspectives the important parameters, probity and creative possibility of *effets de l’irréel* for the (nineteenth-century) French literary-scientific imagination and directions for its onward study. Chateaubriand’s *Atala* therefore offers a test case for rereading canonical nineteenth-century French literary texts for their literary-scientific imagination as also the means to review and renew literary canons.

Chateaubriand’s *Atala*: Encountering Nature and (French) History Through Unspoken Natural History

Since first publication, the critical ink spilled on Chateaubriand’s well-known, iconic, work reflects the enduring appeal of its rich thematic content and formal complexity in response to changing critical preoccupations and theoretical approaches. The challenge of reading, and teaching, *Atala* is therefore to preserve the freshness of first encounter – it is quintessentially about human encounters and their consequences – for its renewed salience in the face of the plethora of expert secondary-critical appraisal, including pocket editions (with introduction, notes, chronologies, dossiers of supplementary materials, bibliography). Critics cannot but focus on *Atala*’s various narrative perspectives and insider-outsider narrators that reveal its visions of France, the French Revolution and French Civilizing Mission by two means. First is *Atala*’s imbrication of multiple contexts challenging hierarchies of ‘progress’ that are the reader’s time – through the parallel historical settings of American first peoples and of both Ancien Régime and French Revolution/First Empire France – and space of France in the world: the ‘peripheral’ geographies of (French) Louisiana and Brittany interrogate among others Napoleon’s recent Expédition d’Égypte (1798–99), 1801 Concordat with the Catholic Church, 1801 Haitian Revolution and onward European conquests aligning with its several editions. Second is *Atala*’s hybrid formal composition comprising visual, aural, factual, poetic, oral and written genres. In this potentially overwhelming complexity of referentiality, standpoint theories such as Kohlstedt’s usefully indicate where and how to locate the immediacy of the text for its ideological ‘gaps’ underscored by the literal blanks on the page signposting a tracery of insights (on the past), blind-spots (of the 1801 present) and peripheral visions

(of future pasts). To resist their multi-referential paralysis, including knowledge/relevance deficit for the twenty-first-century (student) reader, however, is thus to stand in the important ignorance gap of the (student-age) author/narrator of *Les Natchez*, to ask the following questions noted by Jean-Claude Berchet in his superlative pocket edition of *Atala* (1989, 11):

Qu'est-ce que la nature? qu'est-ce la liberté? qu'est-ce que le désir? qu'est-ce qui légitime la société civile? Telles sont les questions que se pose le jeune Breton qui arrive dans le Paris de 1787, un peu comme Chactas dans la France de Louis XIV, en provenance de ses lointaines forêts natales.

The first question here, upon which the others are appositional, not only draws specific attention to the interconnection and disconnection between nature and culture(s) in the text. The first question also specifically engages *Atala's* material-metaphysical purview with a pair of (critical) newcomer eyes as to its literary-scientific imagination. What, then, is 'la nature' in *Atala*, and how is it represented – as universal or as culture-specific – in the different contexts (space-times) of the text that frame post-Revolutionary France (of today)? Applying Kohlstedt's approach to alternative, parallel histories of science hiding in plain sight our subheading spearheads investigation of the connection between 'nature' and 'histoire' (history and story) in *Atala* as also the missing connection between the history of nature and *histoire(s) naturelle(s)*.

Recent secondary criticism and late twentieth-century critical editions of *Atala* are then striking in their overlooking of 'nature' for in the text's many 'ecoregions' (Finch-Race and Gosetti, 2019). Berchet's introduction is indicative (1989, 13–14) in finding room only for the following:

C'est alors, nous dit Chateaubriand (*Atala*, préface de la première édition), qu'il conçut 'l'idée de faire l'épopée de l'homme et de la nature, ou de peindre les mœurs des Sauvages en les liant à quelque événement connu'. À l'objectif proprement littéraire, on voit que se trouve associée dès le départ une démarche qui relève plutôt des sciences humaines: à la fois anthropologique, ethnographique et historique. Pour réaliser une œuvre aussi ambitieuse, les références ne manquent pas: Rousseau (pour la théorie), Bernardin de Saint Pierre (pour la description) ou même Marmontel (pour la dernière en date des épopées en prose à sujet colonial: *Les Incas*). (Emphasis in the original)

In the discipline definitions here Berchet seems unaware of two important anachronisms. The Société Ethnologique de Paris was founded only in 1839 (by William Frédéric Edwards): the Société Anthropologique de Paris was not established until 1859 (by Paul Broca). Indeed, where Berchet then sees in Volney and travel writing of the period 'un objectif "scientifique"' (1989, 15, flash quotes are Berchet's), the literary-scientific ramifications of his qualification remain sidestepped by later notes (for example 1989, 16, 17, 63) referring the reader to a list of sources including 'récits de voyage' (1989, 211–215). Berchet overtly mentions only one in his introduction, 'le Voyage de Bartram' (1989, 17), but without fuller comment. By contrast, Phyllis E. Crump's introduction to *Atala* (1951) more helpfully and scientifically situates Chateaubriand's 'Bartram' as source, because her eye is also trained through her extensive knowledge of (French) nature 'in the Age of Louis XIV' (1928):

In William Bartram, the Quaker naturalist, whose descriptions supplemented his own observations, **he found a genuine love of nature, a sense of poetry and the art of relating**

his adventures in a straight-forward way. In Bartram, as in Chateaubriand, **there is a philosopher as well as an explorer** [...] No passage in Chateaubriand shows more clearly than the description of the *Savane Alachua* **the extent and the limits of his borrowings from Bartram.** [...] Bartram also notes the evening cries of the animals and birds. [...] **There is no close textual imitation of the passage in *Atala*.** (1951, x–xi, bold emphasis added)

To return ‘the Quaker naturalist’ to Chateaubriand’s text through examining and comparing the Bartram intertext/context clearly has limitations. However, to study ‘genuine love of nature’ in *Atala* first rather than second hand is illuminating of its literary-scientific imagination. What does Chateaubriand describe as an eye-witness or as an armchair traveller, and why?

From the outset, as in two further set-piece examples we pick out, nature in *Atala* is never neutral. Indeed, the text can only be approached through the opening seven paragraphs of the *Prologue* frame narrative (1989, 61–65), as Kadish (1982) underscores, for its key symbolisms of exile. Unmissable in these paragraphs, yet largely missed by literary critics is the incipit’s impersonal, overarching, scientific account of ‘nature’. A vast allegedly empty territory is surveyed through the objective, bird’s-eye, gaze of the (Western) explorer-traveller-geographer (over)naming its places, *flora* and *fauna* (including ‘hérons bleus’ and ‘flamants roses’, 1989, 63), but not yet its first peoples (‘des tombeaux indiens’, 1989, 63). The stamp of overriding scientific and cultural authority of this frame for the reader paradoxically makes the individual first-person ‘Indian’ narratives it then introduces – of Chactas, then *Atala* and René – the more authentic and believable. This is especially the case with *Atala*, who does not speak directly until the long set-piece on nature (to confirm she can never be Chactas’s wife, 1989, 95), that is their escape from Chactas’s captors and her adopted tribe. This flight of survival is the counter-narrative to the record of Western scientific exploit in the opening frame. Focalized primarily by Chactas the scene exemplifies the leverage of the literary-scientific imagination (1989, 97–98):

Atala et moi joignons notre silence au silence de cette scène. Tout à coup la fille de l’exil fit éclater dans les airs une voix pleine d’émotion et de mélancholie; elle chantait la patrie absente:

“Heureux ceux qui n’ont point vu la fumée des fêtes de l’étranger, et qui ne se sont assis qu’aux festins de leurs pères!

“Si le geai bleu du Meschacébé disait à la nonpareille des Florides: ‘Pourquoi vous plaignez-vous si tristement? N’avez-vous pas ici de belles eaux et de beaux ombrages, et toutes sortes de pâtures comme dans vos forêts?’ – Oui, répondrait la nonpareille fugitive; mais mon nid est dans le jasmin, qui me l’apportera? Et le soleil de ma savane, l’avez-vous?’

“Heureux ceux qui n’ont point vu la fumée des fêtes de l’étranger, et qui ne se sont assis qu’aux festins de leurs pères! [...]

Merveilleuses histoires racontées autour du foyer [...] vous avez rempli les journées de ceux qui n’ont point quitté leur pays natal! Leurs tombeaux sont dans leur patrie, avec le soleil couchant, les pleurs de leurs amis, et les charmes de la religion.

“Heureux ceux qui n’ont point vu la fumée des fêtes de l’étranger, et qui ne se sont assis qu’aux festins de leurs pères!’

No critic to my knowledge has appraised this extraordinary moment, given that its mode fully represents ‘une sorte de poème, moitié descriptive, moitié dramatique [dans] les formes les plus antiques’ lauded by Chateaubriand in his Préface of 1801 (1989, 37). Epic in its choric refrain phrased also to invoke the Biblical Beatitudes, Atala’s distorting mirror account of ‘blessings’ in her eulogy-lament to her ‘patrie’ also indirectly critiques Chactas’s cross-cultural encounters with other Indian peoples as well as with French culture at the Court of Louis XIV. But it is her parable of the two birds and its lesson so intensely framed by the sentiments of the repeated chorus that reveals Atala’s/ *Atala*’s more complex literary-scientific inspiration since Chateaubriand unusually voices scientific naming and knowledge in Atala’s mouth.

Where talking animals and birds speak human truth in myth, legend and moral tales, there is no moral quality to Atala’s ‘geai bleu du Meschacebé’ and ‘nonpareille des Florides’. Rather they powerfully represent specifically native American ‘natural science’ that is entirely in keeping with Atala’s superior environmental knowledge and instruction of Chactas for their survival (for example 1989, 96) as they migrate from her native territories. Not to be confused with the European bird of the same name, the blue jay of North America and the Gulf of Mexico dwells in their various woodland habitats. It is known for its noisy song, black collar, and similarity of coloration in male and female bird. By contrast, the ‘nonpareille’ or Painted Bunting (also known as the ‘Pape de Louisiane’ for its purple hood) winters in southern Florida, the Caribbean, Mexico and Central America. Unlike the drab female (*la non-pareille*), the male is prized as among the most beautiful of North American birds for the intensity of its colours, and traded in Mexico as a caged songbird. During the mating season the intense cooing of male and female makes their secretive presence identifiable when they are ordinarily solitary (and also monogamous). Clearly identifying with the ‘geai bleu’, which does not migrate and is not taken captive, Atala’s larger lament of her ‘patrie’ in her bird allegory negotiates her exile while comparatively questioning Chactas’s. At various junctures he (and René) debate the merits of their different experiences of exile, migration and other-cultural hybridity, integration and miscegenation (1989, 68 for example). Via Atala’s transposition of tribal and affective positions in her male ‘geai’ and female ‘nonpareille’ interlocutors by contrast, the birds enunciate the impossibility of permanent dwelling in the other’s habitat and, by inference, cross-species mating.

Chateaubriand’s reference source is not song, but the at least double *histoire naturelle* of Buffon as well as Bartram, as Frédéric Cuvier’s *Dictionnaire des sciences naturelles* clarifies (1825, 144):

NONPAREIL (ornith.). L’oiseau ainsi appelé est représenté sous le nom de verdier de la Louisiane, sur la 159^e planche enluminée de Buffon. C’est l’*emberiza ciris* de Linnaeus et de Latham, dont il est fait mention dans la traduction du Voyage en Amérique de Bartram, tom. 2, pag. 47 sous la dénomination de linotte non-pareille, *linaria ciris*, et la passerine-non-pareille, *passerine ciris* de M. Vieillot.

The French translation of Bartram’s *Voyage* appeared in 1799. Once the avian vocabulary in *Atala* is identified as essential to its nature descriptions – birds are everywhere – and to its parallel, contrapuntal, geopolitical and personal viewpoints around marriage, a literary-scientific reading then better attends to the text’s mixed factual-scientific as well

as poetic-figurative lessons on encounter and exile, and non-realist but no less scientific modes for their encapsulation.

Atala's thoroughly noisy song, like that of the otherwise hidden 'geai bleu' and 'non-pareille', thus clearly speak back to the French 'civilizing mission' – religious and scientific – in her territory as (not) the same as was described from the 'bird's-eye' (Western) explorer's view in the opening frame. Once we then also have ears to hear, and thus locate *Atala's* eponymous 'subaltern' (Spivak 1988) speaking her indigenous 'natural history' in her own terms, the compositional positioning as well as content of her song more eminently demonstrates its prefigurative qualities. If the American 'birds' of her parable therefore reinforce Atala's earlier confirmation (1989, 95) that she cannot be paired (as Chactas's wife) by laws of 'nature', these precede and compound the ideological and theological reasons that are Atala's dilemma of marriage to Chactas leading to suicide that are central to the plot. Her fuller revelations come in the famous storm scene following her song (1989, 100–103).

For critics, this set piece exemplifies the pathetic fallacy and high Romantic melodrama of *Atala*. The scene's thunder, lightning, torrential rain and wind-whipped forests magnify the lovers' passions and Atala's secret and its confession. Her fateful religious oath to her mother to remain a virgin in exchange for her mother's salvation is in consequence of the latter's rape and then conversion at the hands of Spanish colonizers. As explanation of Atala's mixed (part-European) birth, the 'lightning' shock for Chactas and the reader is that her father is Lopez, Chactas's principal benefactor. The near incest in Atala's revelation and its effects then require reevaluation when the reader deliberately looks behind Chactas's account focusing on his pain of never gaining Atala. What is the storm scene through her eyes and song? Here are its native woodland habitats not in bird mating season, but swept by equally seasonal (tornado) weather. The bell of the Catholic mission church is to save travellers from such storms. The scene therefore heralds and differently inflects the non-Edenic ending of *René*, when intertribal, territorial conflict between American first peoples – in this case the Cherokees – over lands wipes out (French) colony and Natchez alike (1989, 147) even when the latter carry with them into exile the bones of their fathers as mentioned above in Atala's song. To see America's 'nature' through Atala's eyes then brings other 'non-Edens' into fuller focus in *René*, for example the busy French settlers establishing the colony by clearing the trees of Louisiana with black slave labour as distorting mirror of Versailles (1989, 157). Nature is therefore not the impersonal backdrop of the Western scientific gaze (the opening) but personal and geopolitical as American in the person of Atala as anti-Eve. Of course her (un)necessary silencing and death in the text, as feminist critics differently remark (Segal 1988; Schor 1995), aligns with Atala's unusual voicing of 'natural history'. The inherent bias that excludes women of all tribes and colours from the heart of the European Enlightenment scientific, religious and civilizing project is very much alive in the reader who takes Atala only on Chactas's account.

Atala's extraordinary song then also illuminates how Chateaubriand's reading and rewriting of William Bartram's *Voyage* for its native birds (and other *flora* and *fauna*) reveal his views of nature and of God. These are no Deist, French Enlightenment science accounts of the natural world, nor the apology for creation in Catholicism (thanks to le Père Aubry's charge against its dogma and Jansenism). Rather the 'génie du Christianisme' glimpsed through the standpoint of Atala in her song is

Chateaubriand's sympathetic adoption, and adaptation, of Bartram's observational, devotional Quakerism (Anderson 1990; Clarke 1985). Its respect for the detail of the natural world is for all its environments and created native inhabitants for themselves, rather than for other ulterior teleological, or theological, purpose. Indeed, Chactas never converts from similar beliefs in the natural order of the 'Grand Esprit' and love for Atala in a Louisiana (of Bartram) distinguishable in its 'forêts natales' from the improving geopolitical ravages of incomers. In the end (of *Atala*) the 'pélican du désert' finds a perch on the old rotting wooden cross of the former Mission (1989, 150) and *René* closes on the 'voix du *flamant* qui, retiré dans les roseaux du Meschacebé, annonçait un orage pour le milieu du jour' (1989, 200).

Our reading for the literary-scientific imagination in *Atala* reveals its American 'nature', including its set piece storm scene, to have significant metaphorical, but also local-global 'environmental' import especially where scientific details (*effets de réel*) prompt critical questioning of whose nature – culture, science, history – is at stake, and hence dominant, occluded or destroyed. The leverage of nineteenth-century French *histoires* of all genres to represent France's *Histoire* is of course a cliché that Dix-Neuviémistes live by. The workings and genres of the nineteenth-century French historical novel, history 'cycle' novel, and science fiction – by Balzac in his *Comédie humaine*, Zola in *Les Rougon-Macquart: histoire naturelle et sociale d'une famille sous le Second Empire*, and Verne – clearly demonstrate how the literary-scientific imagination captures and reflects the century's major questions and (positivist) ideas about heredity, inheritance, generation and extinction, and the causal or determining links between them. Dix-Neuviémistes could do more, however, to engage with France's new nineteenth-century disciplines of national historiography and of science, and with the many gaps, blindspots and insights in their narratives. The making of French historiography in the very different national accounts of a Guizot, a Michelet or a Thiers pivots largely on interpretation of key events, such as the 1789 and 1848 Revolutions, the Franco-Prussian War and Paris Commune of 1870–1. These historiographers also published in other genres. Nineteenth-century French history of science similarly pivots on (dates of) first discoveries and on 'founding fathers' – a George Cuvier (1769–1832) for Palaeontology, or a Louis Pasteur (1822–1895) for Microbiology – that (re)define and shape the collective, teleological, narrative of *la France moderne* (scientifique et laïque). But what of 'ancients' in this path who remain or who must fall (like the Ancien Régime), or 'others' deemed peripheral? French history of science is particularly harsh in its construction of discovery as 'revolutions' (Kuhn 1962) and hence dismissal of losers, secondary and marginal players and non-expert forms for serious science dissemination. The double synergy of the literary-scientific imagination revealed new scientific import in the literariness of *Atala* above. Our second case study will now demonstrate that serious science can also better deploy literary rather than official scientific outlets to make the point of its discoveries and, indeed, that the result may also renew literature's imaginary forms.

Adrien Cranile's *Solutré, ou les Chasseurs de Rennes de la France Centrale. Histoire préhistorique: The Serious Joke of Literary Science*

Adrien Cranile's extraordinary work is little known among specialist French archaeologists and historians of science as well as Dix-Neuviémistes, and exemplifies why

knowledge of history of (new) French sciences of the period matters (Goodrum 2014), in order to determine the importance of its integral context, subject matter and overtly witty form. Cranile's [title referents] comprise entirely serious science, but its subtitle as a 'histoire préhistorique' is a scientific impossibility and non sequitur. Prehistory concerns anatomically modern humans, and anatomically-related hominids such as the Solutriens, but neither group had yet produced cave art in this 'période qui, par définition, n'a pas laissé de récit: le romancier est contraint d'inventer' (Guillaumie 2013, 107). But the author, Adrien Cranile, shares the joke of such impossible recording because he does not exist, yet is the author and authority in different guise of the serious science of Solutré. Adrien Cranile is the pseudonym and anagram of Adrien Arcelin (1838–1904), a respected and published archivist, geologist and archeologist who, with Henry Testot-Ferry, discovered at Solutré an important site of prehistoric 'foyers-sépultures' (hearth-burials) in 1866. The key signals of the Cranile-Arcelin *histoire-préhistoire* joke in the '1872' [text] – available on Gallica and cited henceforth – also disappear in Jean Combier's reprint edition (Arcelin 1977), restoring Arcelin's name yet changing both title and subtitle to *Chasseurs de Rennes à Solutré. Roman préhistorique* thus robbing Cranile of his 'histoire préhistorique'. Despite informed knowledge of French works, Angenot and Khouri's first international bibliography of prehistoric fiction (1981) lists neither Arcelin nor Cranile. Since 1999, however, recognition of Cranile's/*Solutré's* merit is to name it as the first, specifically French, example of the sub-genre of 'FP' or 'PF' (*fiction préhistorique*/prehistoric fiction) in mainly Anglophone survey studies of time-travel writing to the deep past (Ruddick 2009; McNabb 2012; Fehlmann 2014; Boldrini 2019) rather than far future of classic science-fiction. *Solutré* is then often (dis)qualified for its legendary (unfounded and invented) 'chasse aux chevaux' episode (Delpont 1977; Poplin 1990), also famously illustrated in the text. After driving the wild horses off the precipitous Roche de Solutré the Solutriens massacred them as food (mirroring nineteenth-century French meat-eating practices). As de Ferry and Arcelin clarified (1868, 7), there is no scientific evidence for the episode from discoveries of unusual quantities of horse and reindeer bones at the site.

To understand *Solutré's* serious literary-scientific joke, however, requires more concerted literary-scientific attention to its 'histoire' subtitle regarding specific French scientific contexts and their authorities. The major elephant, or better mammoth, in the room for French geology and archaeology from the 1840s is the legacy of Cuvier's paleontological work and (anti-transformiste) conviction by his death in 1832. He upheld the lack of evidence for 'l'Homme fossile', despite remains of a fossil 'human' skull being discovered in 1829 in the Grottes d'Engis in Belgium by Philippe-Charles Schmerling (later identified as early hominid rather than human). Speculation, excited discovery in the Neander Valley in 1856 of Neanderthal 1 (as distinct from anatomically modern humans), and also importantly hoax – Boucher de Perthes's discoveries of a human mandible beside knapped flints at Moulin-Quignon near Abbeville in 1863 proved to be a plant by workmen – then spearhead the new scientific field of 1860s French *Préhistoire*, with major discoveries by among others Louis-Laurent Gabriel de Mortillet (1821–1898) and Édouard Lartet (1801–1871). In 1868 (son) Louis Lartet (1840–1899) discovered and identified in 'l'Homme Cro-Magnon' a prehistoric (anatomically modern) human race distinct from Neanderthals. But the French public was also well-informed both at the Exposition Universelle of 1867 through rooms dedicated to French

Préhistoire, and in Napoleon III's repurposing in 1867 of the 'Musée des Antiquités celtiques et gallo-romaines' at the Château de Saint-Germain-en-Laye as France's first 'Musée des Antiquités nationales', to house and develop France's prehistory collections. The big debate concerning human origins as singular Darwinian descent with modification (McNabb 2012), or as multiple, separate hominid and human species was whether, when and how they came into contact, as a result of trading, cohabitation, conflict-extermination and/or controversially inter-breeding. In history of nineteenth-century French geological and archaeological sciences, especially concerning the establishment of French *Préhistoire* of the 1860s, Arcelin figures in these debates with honourable, but never central mention (Coye 2005). Yet Cranile in 1872 is the first *préhistorien* to cross separate disciplinary 'species' to become French *préhistoire*'s first (time-)travel writer. The double scientific and literary standpoints of Arcelin (1868)-Cranile (1872) are therefore key to understanding his purposes in *Solutré* as much more than an insider's romp into fantastical-factual prehistory.

The adeptly crafted, specifically literary, devices of Cranile's text highlight its complex fictional counter-factual authority as well as its frames of publication. *Solutré*'s reconstructions are everywhere doubled by including exceptional illustrations of prehistoric scenes as well as integral use of frame narratives. These will demonstrate Arcelin's 'cran' and punning of 'crâni(e)n' in 'Cranile', to add his last laugh beyond his adept ending for his *Solutré* to which we return as tale of triumph for truth (based in evidence) over fakery, forgery and false representation. By 1870, readers had in fact unwittingly encountered 'Cranile' in striking drawings, including of a 'foyer-sépulture' and of the 'chasse à chevaux', in the 'trente-neuf scènes de la vie de l'homme primitif composées par Emile Bayard' illustrating Louis Figuier's *L'Homme Primitif* (1870), billed on its inside cover page as an 'ouvrage illustré à l'usage de la jeunesse'. As Blanckaert (1993, 31) notes, Figuier's preface makes claims to "une science qui n'existe pas encore". Figuier affirme que 'la science des temps antéhistoriques', la science des 'origines positives de l'humanité', est une 'sorte de chaos' que personne jusqu'ici n'a entrepris de 'débrouiller'. Yet Figuier acknowledges no source for the imaginary illustrations or expert descriptions of flint tools. Arcelin had also produced the specialist illustrations of prehistoric flint implements and other tools for (signed) plates in his 1868 *Mémoire* (with de Ferry) on Solutré.

The acknowledged expert status of Arcelin as key contributor in the latest discoveries and work of French *Préhistoire*, especially of the Reindeer Age, therefore frames the frame narrative opening Cranile's *Solutré* (1872, 5–10) by means of the established literary genre of the 'lost'/edited manuscript. Cranile's friend, Alexandre T., had sent his manuscript to a 'docteur Lehmwasser de Berlin' (a fictionalized Hermann Schaaffhausen, 1816–1893, to whom Johann Carl Fuhlrott had sent bones he had discovered in the Neander Valley for identification), with a letter dated 6 December 1869 explaining the provenance of its 'aventure': 'Ai-je rêvé? ai-je eu quelque hallucination?' (1872, 6). A short reply from Lehmwasser of 20 May 1870 excuses the time delay caused by his own publication of a book entitled *L'Homme fossile* about to appear, but with this post-script: 'J'ai à peine eu le temps de parcourir votre manuscrit. Ce que j'en ai lu m'a beaucoup diverti. Continuez à vous occuper de littérature, vous avez chance d'y réussir quelque jour' (1872, 7). When Alexandre buys and reads the work, readers know already what he will find: 'des chapitres entiers étaient empruntés à son manuscrit et

traduits presque mot à mot [...] un examen plus attentive [...] lui fit remarquer que son nom n'était cité nulle part' (1872, 8). In confiding in the narrator of *Solutré* Alexandre lives shock, disbelief and anger at being duped, including by the death of Lehmwasser to challenge the latter's treatment of him. Resulting spleen and deteriorating health lead to Alexandre's death. As the inheritor and publisher of Alexandre's manuscript, the narrator and 'Adrien Cranile' can then thank MM Hachette for making available

des planches empruntées au beau livre de M. L. Figuier, *L'Homme primitif*. Ces planches, exécutées par M. J. Bayard, d'après des croquis de M. Adrien Arcelin, archéologue versé dans les études préhistoriques, et l'un des explorateurs de Solutré, où se passe le récit qui va suivre seront un précieux complément du texte. (1872, 10)

Fiction now reveals the truth of Figuier's authorship as a fiction: the facts of (Arcelin's) Solutré can now multiply inform Solutré's reconstruction in *histoire préhistorique* through *Solutré's* second frame narrative. This is the narrator's 'hallucination'. After gazing intensely at a flint he has found at the Roche site, he is transported back to its pre-historic times. But not content with this fictional solution for *Solutré* to suspend reader belief in such 'teleporting' to the past, Cranile enlists his geologist-archaeologist friend, a Dr Ogier, to undertake a return journey together to explore the Solutrien era via the same method of flint-induced 'hypnotism'. This calques with sly tongue-in-cheek onto the latest 'hypotheses' (transports) by *préhistoriens* about the Palaeolithic, its subdivisions of the Stone Age based on hominid remains and evidence of differing flint tools.

Only in chapter nine does the 'story proper' then begin: 'Ici, cher et illustre ami, commence véritablement mon récit, et je dois, avant d'aller plus loin, vous affirmer, sur mon honneur, que tout ce que je vais écrire est d'une exactitude scrupuleuse' (1872, 43). The familiar disclaimers of travel writing wittily authenticate this adventure into the fictional worlds of the Solutriens as the lens through which Cranile views his, and Ogier's, French nineteenth-century human modernity, and thus witnesses the 'missing links' in France's *Préhistoire* to explain its *histoire*. Space permits discussion here of only two of Cranile's several inventive literary strategies as part of his larger literary-scientific joke. First is the person of the fictional, free-thinker, docteur Ogier as a (comic) anachronism in Solutré: 'Un savant est un objet de luxe incompatible avec les dures nécessités de la vie barbare' (1872, 77). His refusal in the periglacial conditions to exchange his (1870s) habits and customs for garments of animal skins (that the narrator willingly dons) confirms his ridiculousness in the face of survival mirrored by his obsessions, not with gathering fuel and food, but with dating, recording and 'specimen' collecting (for example 1872, 118, 144) to take every advantage of discoveries for 'positivist' science at the end of the story. His pompous, fixed, exaggerated, and even offensive scientific views for their misogyny and racism, provide further parody of the (mis)application of the evidence and (questionable) science of craniology for the 1872 and modern reader. For example, despite the superlative physical and mental attributes of the main female protagonist and leader of the Solutriens, I-ka-eh, before him, Ogier's pronouncement (akin to the theories of J.-J. Virey) on woman/all women is that it is

écrite, pour qui sait lire, en caractères lumineux sur le crâne et le squelette du sexe qu'on appelle avec raison le sexe faible. La femme est [...] un être imparfait, infirme, mal équilibré, frappé d'un arrêt de développement. Elle porte les traces palpables, incontestables d'une infériorité native. La science le démontre. Un crâne de femme est plus près, à égalité de

race, d'un crâne de chimpanzé qu'un crâne d'homme. [...] La femme qui pense est un cas tératologique, une monstruosité. (1872, 75)

His racial obsessions then translate into his (comic) washing of the Solutriens of the dirt of their 'visages d'hippophages' (1872, 117), so that he can study their 'caractères crâno-logiques' to ascertain 'les conclusions depuis si longtemps formulées par mon savant confrère le Dr Pruner-Bey. Voilà bien son groupe mongoloïde; le voilà vivant en chair et en os! et vous avez devant vous les plus anciens habitants de l'Europe occidentale' (1872, 118). The truth (as we will see) is then challenged for its logic by the fictional narrator unable to square such a claim with the place of the Gaulois in French prehistory. Ogier does not miss a beat: 'mais les Gaulois ne vinrent que plus tard; ils appartenaien à une autre branche de la famille humaine, à la branche aryenne, la plus riche de sève, la plus féconde, noble, grande et souveraine entre toutes' (1872, 118). In fact Ogier quickly leaves the Solutriens (and the narrator) to join his 'tribe', the invading, altogether superior, 'Aryens', whose likeness to the invading Prussians in 1870 could shock the reader of 1872. Arcelin's co-discoverer, de Ferry, is not Ogier's model since Cranile inserts a cheeky editor's note (1872, 199–200) referring to their real joint publication of 1868 as evidence for the discovery that terminates the story. Based on the tongue-in-cheek discussion of the Solutrien dialect (and the name and spelling I-ka-eh) according to linguistic theories of 'dialectes aryens' in which the narrator 'ne trouve pas le singe' *Solutré* (1872, 119–120), my best suggestion is phonetic association with free-thinker geologist Mortillet – M-O-rt-ILLET – as the likely butt of this caricature since his views consistently differed from those of (the Catholic) Arcelin. Mortillet also visited Solutré around 1871 (Combiér and Montet-White 2002, 15).

But the second joke is the positioning of the more enlightened narrator as the object of immediate love interest in *Solutré*, when the young, beautiful and intelligent female leader of the Solutriens, I-ka-eh, sizes him up much more favourably as her 'fiancé' by comparison with the story's tall, brawny Solutrien villain, 'Patte-de-Tigre' (who will die at the narrator's hand). From the outset this central plot device could not more radically overturn the presumed 'natural' hierarchies in nineteenth-century (French) theories of sex and race, enabling Cranile/Arcelin to reconstruct prehistoric Solutrien society as more advanced in light of its more equal gender (and intertribal) relations than colonial France in 1870. Ogier's prejudicial refusal to integrate, determining his escape to join the superior 'Aryan' races in the region, then plots prehistoric encounter between early hominids and anatomically modern humans. These invaders eventually overcome the less war-like Solutriens led by I-ka-eh and aided by the narrator. As a prehistoric Jeanne d'Arc (another Arcelin joke?), however, I-ka-eh is already carefully identified from the beginning as other to the invading Aryan and the native Solutrien alike: 'Il y avait chez elle ce mélange de force et de finesse qu'on ne rencontre guère que chez les races indo-européennes les plus pures' (1872, 64). If *Solutré* therefore unusually for its times holds up its emancipatory lead woman, I-ka-eh, as of a race apart (*non-solutrienne, non-aryenne*), then the implications for the joke of the text's role reversals is how the narrator's story will end. Will death or marriage as the only choices and fates usually available to the heroine be his, or will he awaken from his 'hallucination' as a male Sleeping Beauty before/upon the prehistoric princess's kiss? In guise of a spoiler alert, the ending of *Solutré* is an exemplary literary-scientific *tour de force*. By embracing I-ka-eh literally

and metaphorically by remaining with her by choice in the face of the invading Aryans scaling the Roche de Solutré (the Solutriens' natural defense), the narrator then loses his bride as she jumps from the summit to escape her fate in enemy hands and is fatally wounded on the cliffs below. He can only rescue her body and bury it at its foot under a pile of rocks before waking up in modern time (1872, 198–199):

ici [...] se termine mon récit. Des fouilles que j'ai fait opérer il y quelques jours sur le petit mamelon du Mont-de-Pouilly ont mis au jour une tombe et un squelette [...] d'une femme. La tête qui accuse dans toute sa pureté le type celtique, porte une large fracture de crâne, et toute la face est écrasée et brisée. N'est-ce point une nouvelle confirmation de la réalité de mon rêve? Expliquez cela comme vous voudrez, mais en attendant que la science tranche la question, le crâne du Mont-de-Pouilly est classé dans la collection du Dr. Ogier, au No. 341 sous le nom d'I-ka-eh. Je le tiens à votre disposition, s'il vous est agréable de l'étudier. FIN

Referenced in the fictional editor's note, Arcelin's *Mémoire* with de Ferry had already provided the scientific description (1868, 22): 'Le squelette, qui était celui d'une femme finnoise reposait étendu sur des os brûlés et pilés. Il avait à ses côtés des os de cheval et de renne et trois couteaux de silex'. Like the fictional Alexandre, Arcelin had sent the human remains from the Solutré burial sites to an authority for identification, the German anthropologist, Franz Ignaz Pruner-Bey (1803–1882). He confirmed their provenance as 'de race mongoloïde' of now four types, 'lapon', 'finnois', 'le type [...] des Eyzziès' and 'un type particulier jusqu'à présent à Solutré, que M. Pruner-Bey a nommé esquimoïde' (1868, 25). Cranile rewrites these conclusions in Ogier's mouth (1872, 118 above). To put *histoire*, *préhistoire*, and Cranile's wonderful stretch of the literary-scientific imagination in *Solutré* together as PF, Arcelin's discovery as a *préhistorien* of this skeleton reveals his fictional female protagonist as the fruit of his labours of first discovery and specialist publication, and of the most recent craniological research by Pruner-Bey and Paul Broca. In I-ka-eh is also Arcelin-Cranile's anagrammatic claim to his scientific work and discovery, his 'Eur-I-KA' moment.

Solutré's multi-contextual frames and literary framing devices therefore eminently confirm it as a 'type specimen' of scientific *histoire préhistorique* rather than merely *fiction préhistorique* for the innovative reach, inventiveness and ludic potential of the French literary-scientific imagination. Its serious side, however, is revealed in *Solutré's* unusual depiction of gender and race in its peaceable, egalitarian, ancient 'French' culture before Aryan invasion. Its representations of gender clearly defy what Ruddick (2007) identified in PF's 'wife-capture topos' as 'Courtship with a Club' by more importantly challenging ideas through its narrator about 'prehistoric' masculinities as also informed by race. Against the backdrop of the Paris Commune (1870–1) as well as the Franco-Prussian War (1870; as noted by Ruddick 2009), *Solutré's* depictions of 'non-Aryan' community on the Roche de Solutré alongside other prehistoric peoples more radically challenge key nineteenth-century French assumptions about race and gender *relations*, and their presumed hierarchies. Is the '(non-)Aryan' within, outside, other? *Préhistoire* as newcomer to French natural, medical and human sciences is no less troubled than are literatures of the period by questions of origins and national heritage(s).

But *Solutré* also brings the Dix-Neuviémiste down to earth, to face the issue of the authority and prejudicial academic priority of French metropolitan ('high') cultural

and science productions, and their canon constructions. If *Solutré* and Arcelin-Cranile re-centre the hitherto peripheral places and marginalization of provincial science as now leading the field of discovery, their challenge is also double. They remake narratives of first discovery, innovation, and the place of research on (French) *préhistoire(s)* of the 1860s as pivotal to understanding the onward civilizing missions of the Third Republic including the archaeology of North Africa. In forging *histoire préhistorique*, *Solutré* also remakes the distinction between expert (factual) science writing and imaginary (creative) science writing by challenging and enlarging popularization of science (by a Figuiet) and realist literary science (by a Zola). Arcelin is no Goethe or Kleist, but *Solutré* demonstrates that writers of science can also be creative writers who reframe and renew literary genres. Beyond setting the bar for French *fiction préhistorique*, I would contend that *Solutré* also clearly sets out new scientific visions for larger literary-critical engagement by Dix-Neuviémistes with the French ‘roman du terroir’. George Sand’s work of the period is also representative of its double vision. Our third case study now examines *Laura ou Voyage dans le cristal* (1864) for its important development of French (women’s) literary-scientific writing ‘à l’usage de la jeunesse’.

George Sand’s *Laura ou Voyage dans le cristal*: The Reach of the Literary-Scientific Imagination to Critique the Real Worlds of French Science

Had Arcelin read Sand’s *Laura* when it appeared so aptly in the *Revue des Deux Mondes* in 1864, or are the many similarities serendipity? Frame devices link journeys back into ‘geological’ time triggered by hypnotic light effects of stone (amethyst geode, rather than flint). The main male protagonist-narrators share broader curiosity, impressionability and sensitivity to the marvelous-real than possessed by their positivist ‘geoscientist’ foils (Sand’s Walter and Uncles Tungstenius and Nasias; Cranile’s Lehmwasser and Dr Ogier). Moreover, the striking interest of active, intelligent and beautiful female leads in *Laura* and I-ka-eh in these scientific love story explorations then also distinguishes Sand’s tale from Verne’s heroic scientific adventure(r) models in *Voyage au Centre de la Terre* (1864) for example, to which *Laura* has been compared (Vierne 1969; Mustière 2014). Indeed, renewed critical interest in Sand’s *Laura* for its garden geo-poetics (Kocik 2012), important engagement with crystallography (Mathias 2013), and ecofeminist ‘volcanic imagination’ (Illingworth 2020) all differently ponder, but do not press out, Sand’s prescient critical engagements with two major blind spots of French positivist sciences. The first is the absence, or only marginal place of women in their making. Second, as empirical, reason and evidence-based, they are also exclusionary of the *imaginary* and speculative. Sand’s overt choice of the *conte fantastique* for young audiences provides her ideal medium and vehicle for her message. *Laura*’s imaginative-fantastical polar travel with her irrational ‘scientist’ Uncle Nasias – punning on ‘Asie’ and ‘niaiseries’ (2007, 62 & 68) – reappraises the natural world and its sciences not as unscientific/false. Rather they capaciously include explicable and inexplicable natural phenomena and their knowledge, including by women. In *Laura*’s *mise en abyme* of geode narratives, Sand’s stretching of the imaginary worlds she creates identifies the problematic realities and authorities of 1860s empirical, positivist sciences by inverting them.

The reader’s first acquaintance with the text’s main narrator, ‘marchand naturaliste’, M. Hartz, is pivotally through the unidentified opening (male) frame narrator’s

positionings with regard to science knowledge: ‘je m’intéressais médiocrement aux objets précieux qui encombraient sa boutique’ and [on accidentally dropping a stone that reveals it is a geode] ‘Je ne sais [...] ce que c’est au juste qu’une géode, et n’ai nulle envie de le savoir’ (2007, 15–16). M. Hartz’s reply is no less important for the double debate of the frame narrative, namely the chasm between ‘l’artiste’ and the ‘savant’ in the 1860s, and *contes de fées* as genre of fantasy entertainment (only).

- Pourquoi? reprit-il; vous êtes artiste pourtant?
- Oui, j’essaie de l’être; mais les critiques ne veulent pas que les artistes se donnent l’air de savoir quelque chose en dehors de leur art, et le public n’aime pas que l’artiste paraisse en savoir un peu plus long que lui sur n’importe quoi.
- Je crois que le public, la critique et vous êtes dans l’erreur. L’artiste est né voyageur; [...] il est autorisé à parcourir tous les chemins du monde. Donnez-lui n’importe quoi à lire ou à regarder, étude aride ou riante [...] Il s’étonnera naïvement de n’avoir pas encore vécu dans ce sens-là, et il traduira le plaisir de sa découverte sous n’importe quelle forme, sans avoir cessé d’être lui-même. [...] Donc, poursuivit M. Hartz, vous avez parfaitement le droit de vous instruire [...] Il n’y a point de danger à cela pour qui est vraiment artiste.
- De même qu’un vrai savant peut être artiste, si cette excursion dans le domaine de l’art ne nuit pas à ses graves études?
- Oui, reprit l’honnête marchand [...] Il me donna une loupe, et je reconnus que ces vides représentaient, en effet, des grottes mystérieuses toutes revêtues de stalactites d’un éclat extraordinaire [...] et j’ai trouvé que l’échantillon était une sorte de résumé de la masse: [...] et ces cristaux choisis que vous me montrez me donnent l’idée d’un monde fantastique où tout serait transparence et cristallisation. Ce ne serait point une confusion et un éblouissement vague comme je me l’imaginai en lisant ces contes de fées où l’on parcourt des palais de diamant. Je vois ici que la nature travaille mieux que les fées. (2007, 16–17)

In prefiguring by nearly one hundred years C.P. Snow’s 1959 Reith Lecture, ‘The Two Cultures and the Scientific Revolution’, Sand’s literary-scientific incipit is no less tongue-in-cheek than Cranile’s frame narrative. The issue is both ‘qui est vraiment artiste’, ‘un vrai savant’ and whether either can be both (like Arcelin-Cranile), as *Laura* will then illustrate in M. Hartz’s story, his *Voyage dans le cristal*, as ‘proof’. But the frame narrative also repeats a serious Sandian stratagem (used for example in *La Marquise* of 1832), where the unidentified male frame narrator is a mouthpiece of received ideas concerning the arts (in different genres) and hence the ‘artiste’, to frame Sand’s eponymous fictional woman protagonist as also an ‘artiste’ (who then challenges the assumed male bias of its grammatically neutral form). The ‘artiste’ of this opening thus specifically targets artists who are also highly informed – hence figuring Sand herself as such a writer behind this frame, as strongly encouraged by the fictional M. Hartz ‘pour qui est vraiment artiste’ – before M. Hartz the male protagonist then normalizes ‘artiste’ (as ‘lui’) along with ‘savant’ and ‘voyageur’ as not possibly female. The eponymous *Laura* and Sand’s *Laura: Voyage dans le cristal* as ‘conte fantastique’ thus deliciously disprove this notion. But they may do so only in imaginary, scientific, polar worlds where the woman is in the lead, and ahead concerning her knowledge,

waiting for the men (Alexis the narrator, and Doppelgänger mad-scientist-father Nasias) to follow. In then returning Laura to the happy-ever-after marriage plot when *she* breaks the ‘spell’ of crystal forces magnetically impelled by Alexis and repelled by Nasias in the ‘voyage dans le cristal’ to follow her, Sand would appear to undo in her ending Laura’s clear female scientific agency of her tale (2007, 148–149):

La divine Laura du bon M. Hartz [...] n’avait plus rien de transparent dans sa personne: c’était une ronde matrone entourée de fort beaux enfants, devenus son unique coquetterie; mais elle était fort intelligente: elle avait voulu s’instruire pour ne pas trop déchoir du cristal où son mari l’avait placée, et, quand elle parlait, il y avait dans son œil bleu un certain éclat de saphir qui avait beaucoup de charme et même un peu de magie.

This *clin-d’œil* to Sand’s self-portrait is to the informed (woman) artist of the frame. As also a cameo of the intelligent woman connected to men in science, Sand lays bare why the divine (scientific) Laura is absent: in the real French nineteenth-century world ‘Lauras’ cannot train to be *femmes scientifiques* in their own right, let alone lead in their field of science. Their only route to science is via a father, a brother or a husband scientist (Abir-Am and Outram 1987).

However the further path open to such a woman is to reset her unusual scientific virtuosity in non-scientific literary forms that also turn her knowledge into others’ instruction. A pivotal example, Jane Marcet’s *Conversations in Chemistry* of 1805 (Marcet 1809), may have inspired Sand. *Laura* exemplifies such a literary-scientific ‘échantillon [et] une sorte de résumé de la masse’ (Laura, 2007, 18) in its glittering inventiveness that displays the (occluded) powers of women in the sciences. The important identification by Mathias (2013) of René-Just Haüy (1743–1822) as Sand’s scientific informant for *Laura* is not only for his *Traité de minéralogie* (1801). Haüy’s *Traité des caractères physiques des pierres précieuses* (1817) has as its subtitle *Pour servir à leur détermination lorsqu’elles ont été taillées*. Sand’s cutting and polishing of its scientific contents in *Laura* is multiple, for fact and for fiction. The opening ‘table des matières’ provides an alphabetical ten-page index (‘résumé de la masse’) of French gemstone names. Her text features an extraordinary number for their real and figurative-associative effect. Of the many quartzites in the text associated with Laura (for example 2007, 32), the ‘aventurine ordinaire’ (Haüy 1817, 194, and ‘orientale’ 195) collocates with her roles because it sits in close proximity to the ‘cornaline’, ‘d’un rouge de sang, d’un rouge de cerise, ou d’un rouge pâle; plus ou moins translucide’ (Haüy 1817, 198–199). This is Sand’s gemstone of choice in the ring Laura gifts Alexis (upon her engagement to Walter) with its ‘vive irradiation d’or rouge qui lui permit de voir Laura assise près de [lui]’ (2007, 48). Such ‘magic’ properties in Sand’s text, including as its last word, thus match the scientific properties of gemstones in Haüy’s *table de matières*; ‘électricité’ (including ‘à l’aide du frottement’, ‘attractions et répulsions’), ‘magnétisme’ and ‘réfraction de la lumière’. Because this information is further systemized in tabular form in the closing ‘Distribution technique des pierres précieuses avec leurs caractères distinctifs’ in Haüy’s *Traité* (1817, 236–253), Sand can accurately exploit the properties of key columns – such as ‘accidens de lumière’ and ‘réfraction’ (including ‘double’) – to identify gemstones that align ‘phénomènes les plus curieux’ (Haüy 1817, xix) with the fantastical elements in the dynamics of character, plot and display-interplay of natural/supernatural crystal phenomena in *Laura*.

But the pivotal moment of the frame narrator's dropping of the stone-amethyst geode opening the *mises en abyme* of her text that will then take Laura, Alexis and Nasias to Greenland is already inspired by Haüy's *Aventurine*. There he reported how a worker, accidentally dropping brass filings into vitreous matter, gave it the name (1817, 195), just as the 'Pierre des Amazones aventurine' (1817, 215–216) is only found in Russia and Greenland. The marvelous-real worlds of his crystallography treatise and of nature, and of the microcosm reflecting the larger macrocosm of the geode in Sand's *Laura*, could then have no greater moment and significance in France in 1864. Some twenty rocks of the so-called 'Orgueil' meteorite fell to Earth near this site in the Tarn region and were studied by François Stanislaus Clöez (1817–1883), professor of chemistry at the Paris Muséum National, who discovered organic matter in their inorganic chemistry. Whether serendipity or her *clin d'œil*, Sand's filling of the fantastical 'vides' and 'grottes mystérieuses' of the amethyst geode and other gems of science in *Laura* not only refracts through Haüy the ideal 'artiste (informée)' of her frame. Through galvanizing the very powers of 'contes de fées où l'on parcourt des palais de diamant' that *Laura*'s frame narrator dismissed, Sand's larger lapidary end for her imaginative transformation of mineral sciences is for their therapeutic educational benefit. New futures for the informed young French woman reader-scientist will realize the powers of the imaginary, trailblazing, Laura in her *Voyage dans le cristal*. In Nasias and his ruthless exploits, they also warn of the dystopian visions for science undertaken only by fanatical professional male scientists. Sand's extension of the reach of *contes de fées* in *Laura* for the French literary scientific and the scientific imagination then also prefigures the similar work of Arabella Buckley (1840–1929) in Victorian studies, lauded for her *The Fairy-Land of Science* of 1878 (Buckley 1888).

Conclusions

The important 'peripheral visions' of these three case studies have identified how constructive, informative, creative and ludic are the parameters and powers of the nineteenth-century French literary-scientific imagination in different specialist scientific and literary domains that further dynamize the range of their generic forms. Although very different, each of these texts also demonstrated the scientific as well as creative probity of their writer, to enlist rich critical, as well as artistic, possibility for the French literary-scientific imagination in non-realist as well as realist genres. The pivotal importance of the frame narrative device in each case not only determined the (scientific) authenticity of the story within its frame. It also revealed how the inner story could then better and variously question the over-valorization of Enlightenment (*Atala*), positivist (*Solutré*) and chemical (*Laura*) knowledge and value systems for their truth claims, authority and major blind spots. The question of genre in all three also highlighted the otherwise silenced spaces of alternative female and non-first-world voices hidden in plain sight, but revelatory of the distorting prejudices of high cultural and scientific work in nineteenth-century France.

Our studies then challenge Dix-Neuviémistes also to think outside familiar boxes. To address (i) the intertextualities and (ii) the multiple contexts of French natural, geological and medical sciences currently still on the periphery of mainstream literary-cultural study is an important, but only a first step to engaging the broader reach of the

nineteenth-century French literary-scientific imagination as transformative of both its qualifying terms. We have illustrated the necessary second step, which also illuminates the literary-scientific for new ways of reading canonical, little known and ‘children’s’ writing in French. We have also showcased how all three texts differently challenge metropolitan assumptions about geographical and disciplinary centres and urban forms by reconfiguring the vital discovery spaces of sciences and literatures of ‘terroir’ hitherto considered marginal, peripheral or provincial in the lights of the familiar literary names and texts in nineteenth-century French studies. French *préhistoire(s)* of the 1860s vitally add to our field, because they also point up with Kohlstedt (1978) the gaps and problems with positivist French historiography and historical fiction. But the Dix-Neuviémiste has important multi-contextual and linguistic work to do to make much more of the literary-cultural significance of French vocabularies of the scientific and natural world as the international vernacular of science. My modest proposal is that in pursuing study of the French literary-scientific imagination we may make a more robust case for why our field matters in current Humanities research for its (self-)critical standpoints on the Western Colonial nineteenth century. We can also show how the French literary-scientific imagination is linguistically and fantastically fun.

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