



William John Burchell: The multi-skilled polymath

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On the bicentenary of William John Burchell's sojourn and journey in southern Africa, we review his contribution to science in the region. In November 1810, Burchell arrived in Cape Town and, in mid-1811, he set off on a 4-year, 7000-km journey of scientific exploration. When he returned to Cape Town in April 1815, he had amassed 63 000 specimens and 500 drawings. Burchell is remembered mainly for his contributions to descriptive and philosophical aspects of natural history of the country. He is less well known for some significant and novel contributions to the earth sciences, the social sciences and even astronomy. Burchell's observations in physical geography and geology and his contribution to cartography have received little attention. In natural history, some of his views were prescient of the concepts of evolution and holism. In the social sciences, he provided unique ethnographic descriptions, developed an orthography of two indigenous languages and produced drawings that have attracted international research. William John Burchell is worthy of our memory.

Biographical sketch

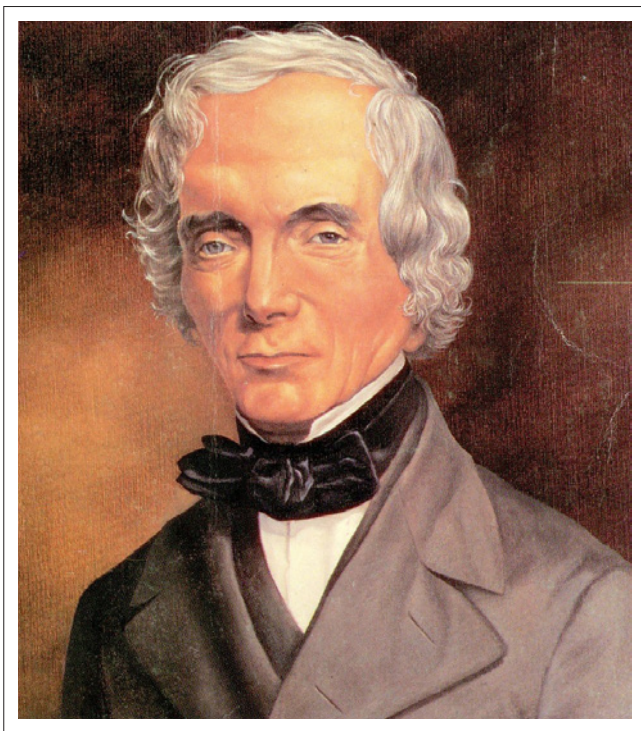
William John Burchell (Figure 1) was from Fulham, London where he was born in 1781 and died in 1863. His privileged schooling, at Raleigh House Academy in Surrey, his self-study and his friendly relationships with famous naturalists of the time were typical of the Enlightenment. He was educated in the *trivium* and *quadrivium* from medieval times, evidently extending to the modern version, as described by George Bugliarello.¹ Burchell studied botany and its practical application both in the family's nine-and-a-half acre Fulham Nursery and Botanical Gardens and as an apprentice at the Royal Gardens in Kew. Sir William Hooker, the systematic botanist and the first director of the Gardens, was Burchell's colleague, friend and, in some respects, his mentor; much later, their relationship deteriorated. Burchell was surely also influenced by the controversial botanist and horticulturalist, Richard Salisbury, who left his estate to Burchell. One of Burchell's close friends was William Swainson, the naturalist, collector, artist and illustrator with whom he shared numerous interests. Some of their taxonomy discussions must have been interesting: Swainson was a Quinarian and Burchell a Linnean. Burchell was deeply saddened by Swainson's emigration to New Zealand in 1841. Charles Darwin knew Burchell and was aware of his observations of numerous adaptations in nature. In turn, Burchell attended the public presentation of Darwin's and Wallace's theory of evolution and the ensuing, famous debate (*infra*). Burchell had been impressed by Hinrich Lichtenstein, the naturalist, southern African traveller and physician, whom he met on St. Helena. Lichtenstein must have been impressed too: many years later, through the King of Prussia, he tried, unsuccessfully, to entice Burchell to move with his collection to Berlin, where Lichtenstein had established the Zoological Gardens and was director of the Zoological Museum. Another of Burchell's friends was the army officer, artist and naturalist, Charles Hamilton Smith, who was particularly interested in Burchell's quadrupeds.

While Burchell's primary interest was natural history and, in particular, botany, it may be argued that he was a polymath, who also had numerous skills. He certainly knew a lot about a lot and he could do a lot. Although Burchell had much in common with his fellow 19th-century naturalists, he was different: he was also a geographer, natural philosopher, ethnographer, draughtsman and artist, talented linguist and an accomplished author. In this regard, he may be compared to the multi-talented Robert Gordon, John Barrow and Johann Reinhold Forster who had been in southern Africa before him (although Forster had visited for only a few weeks with Captain James Cook.)

In his unquenchable thirst for knowledge and desire to travel, Burchell undertook extensive field work, funded from his savings and advances from his sole source of income: the family's profitable nursery business. His travels in search of knowledge included St. Helena (1805–1810), where he was appointed official botanist to the English East India Company; South Africa (1810–1815); and Portugal, Tenerife and Brazil (1825–1830). On 26 November 1810, the 29-year-old Burchell climbed on to the wooden jetty near Cape Town's Castle. Almost immediately, he



started botanising and preparing for his journey into the interior. On 19 June 1811, he departed Cape Town 'with a mind free from prejudice' and 'solely for the purpose of acquiring knowledge'^{2(p.v)}. He travelled north-east, to about 150 km north of Kuruman, explored the Ky-Gariiep (Vaal) River and returned to Cape Town via Graaff-Reinet, the mouth of the Great Fish River, Uitenhage, Mossel Bay and Swellendam. When he returned to Cape Town in April 1815, he had travelled approximately 7000 km, most of it on an ox-wagon (Figure 2). Burchell had contact with two missionary travellers in the country. In Graaff-Reinet, he met John Campbell and gave him advice on travel through Bushmanland and, after Burchell's return to London, he assisted Christian Latrobe with the scientific names of plants and animals that Latrobe listed in his book.



Source: Fred Burchell

FIGURE 1: William John Burchell (1854).



Source: Oxford University Museum of Natural History

FIGURE 2: Interior of Burchell's wagon.

Burchell had been enthralled with and inspired by Africa:

Nothing but breathing the air of Africa and actually walking through it and beholding its inhabitants ... can communicate those gratifying and literally indescribable sensations ... and ... a scene ... which may be highly instructive for a contemplative mind.^{3(p.443)}

Burchell's contribution to science was acknowledged by his peers, but he never acquired the wide public recognition of some. When the 29-year-old Burchell arrived in Cape Town, he had been a Fellow of the Linnean Society of London for 7 years, one of the youngest ever to be so honoured. Two further honours were bestowed on him: in 1832, he was made a Life Member of the British Association for the Advancement of Science and, in 1834, Oxford University awarded him the prestigious honorary Doctor of Civil Law. Even though he deserved the recognition, Burchell was not honoured by the Royal Society or the Geographical Society, probably because of his conflict with the influential John Barrow.

Burchell was hurt by John Barrow's disparaging and insulting comments, published anonymously, on Burchell and others who knew the Cape of Good Hope, such as Latrobe.^{4,5} It drove Burchell to respond sharply and also unwisely to refer to Barrow's 'excuse for a map ... so defective that it can seldom be found of any use'^{6(p.557-558)}. He was also deeply wounded when his biological specimens were not returned or, as with the British Museum, not well looked after. His interaction with the Museum's staff became strained; perhaps there was some sarcasm when John Gray, the keeper of the Museum's Zoological Collections, named Burchell's zebra *Asinus burchelli*.⁷

There was a darker, sadder aspect to Burchell's emotions and behaviour. Although not particularly gregarious, Burchell made numerous friends in the Cape and he was engaging in Brazil. However, after his return from Brazil, he was initially active but increasingly isolated himself, even from his colleagues and friends in science, including Hooker. Collateral evidence of his isolation is to be found in his correspondence: Helen McKay listed 175 letters that Burchell wrote from 1800; only 13 were written between 1840 and his death in 1863.⁸ Back in London, Burchell focused almost exclusively on cataloguing his vast botanical collections, of which he became overly protective. As a consequence of this focus, Burchell neglected to catalogue comprehensively his geological and anthropological collections and also much of his zoological collection. He was relieved of running the family nursery business, which had been sold but, now, he was distracted by numerous domestic and legal duties (he was the executor of two estates: his father's and Salisbury's, and had also been the sole heir).

After Brazil, even his enthusiasm for drawing seems to have fizzled. Both his contemporaries (e.g. Hooker) and some historians have criticised Burchell for his poor publication record. Burchell did not publish anything significant in scholarly journals or anything about his work or travels in Brazil. His tragic death provides an important clue to our



understanding of an underlying cause other than distraction by his duties. At the age of 82, he was a disillusioned recluse. After an unsuccessful attempt at suicide by gunshot, he hanged himself in a garden shed.⁹ Burchell's progressive, self-imposed isolation after Brazil, the replacement of his love of science and art by an almost paranoid pre-occupation with his collection of botanical specimens and his tragic death, all suggest that he was deeply troubled for at least three decades, possibly suffering from a disorder in the depression–bipolar spectrum.

While Burchell may have had difficulties with human relationships in later life, Helen McKay reminded us that Burchell was a humanist who firmly believed 'that the good and worthy of every nation are equally our countrymen ... and equally claim our hospitality and friendship'^{2(p.60)}. It is likely that this ethic explains, in part, why he was so well received on his southern African travels. A San family even entrusted a young boy to his care. Burchell was the first visitor to travel safely the direct route between Klaraarwater and Graaff-Reinet, an area inhabited by the feared San; he undertook this journey three times in 1 year.

Unfortunately, Burchell's book covers only the period from his arrival in Cape Town to his departure, in August 1812, from Litakun (now Dithakong, about 60 km north-east of Kuruman).^{2,3} Almost certainly, additional volumes were contemplated; however the manuscripts, if they existed, were not found after his death. Nevertheless, Theal remarked that Burchell's book:

is one of the most trustworthy and valuable books ever issued upon South Africa ... up to the first quarter of the nineteenth century ... He was a conscientious man, a scholar, and a philosopher...¹⁰

The bicentenary of his journey is an appropriate opportunity to review Burchell's search for knowledge, his wide-ranging interests, observations and thoughts during his journey in southern Africa.

Natural history

Burchell acquired knowledge by intelligent and skilled observation in the field, rather than by experimentation. When he departed from Cape Town for England, his luggage included 63 000 biological specimens: plants, seeds and bulbs, insects, skins and bones, more than 500 drawings, numerous anthropological artefacts and his extensive field notes and journals. The scale of specimens he collected may be compared with the collections of previous eminent botanical explorers of South Africa. The Swedes, Carl Peter Thunberg¹¹ and Anders Sparrman¹², collected 3100 and a few hundred Cape species, respectively, and both were honoured with bicentennial republication of their books. Francis Masson accumulated less than 2000 specimens over 12 years.¹³ Burchell's later expedition to Brazil netted many more specimens, including more than 16 000 insects, some 7000 different plant species and about 200 species of birds.¹⁴ His herbarium had by then grown to about 140 000 specimens.

Almost 80 years ago, Helen McKay studied Burchell in great detail. She wrote about Burchell the scientist,¹⁵ and, in a four-part series of articles, she summarised his life, work, other travels and his contributions to botany.¹⁶ Burchell's most extensive contribution to southern African science was in botany. The Royal Botanic Gardens in Kew conserves the vast majority of his botanical specimens, catalogues and related documents. During the 19th century, Peter MacOwan, the local botanist, acquired approximately 700 of Burchell's botanical specimens, probably duplicates: 500 from South Africa and 200 from Brazil. They are now conserved in the Selmar Schonland Herbarium at Rhodes University in Grahamstown. The remainder of Burchell's collections and documents are at the Oxford University Museum of Natural History. It was more than 160 years after Burchell's return that some of his South African zoological collections were analysed, catalogued and reported; for example, the bird collection was reported only in 1983.¹⁷ There are 194 ethnographic artefacts, mostly from southern Africa, at University's Pitt Rivers Museum. The Linnean Society has a collection of his correspondence.

John Hutchinson, former Keeper of Museums at Kew, summarised Burchell's botanising travels in South Africa, commenting that 'Burchell was surely one of the first ecologists...he gave enumerations of the plants from various localities exhibiting the geographical and local associations'¹⁸. Burchell laid the foundation of Botanical Geography in South Africa with his *Catalogus Geographicus Plantarum Africae Australis Extratropicae*, reputed to be the first of its kind. In its 14 handwritten volumes, he listed all the plants according to place and date of collection. Burchell also produced the manuscript *Catalogus Geographicus Plantarum Brasiliae Tropicae*.

Numerous plant and animal species are named after Burchell, as is one monotypic plant genus (Figure 3),¹⁹ the only species of which is *Burchellia bubalina*,²⁰ the beautiful wild pomegranate indigenous to the Cape floristic region.

Burchell pleaded for the recognition of South African flowers. He recommended the establishment of public botanical gardens in Cape Town: 'the sum of money required for maintaining it would be but trifling, in comparison with the advantages which science ... would derive from it'^{2(p.24)}. Although he did not recommend the site, he described the Kirstenbosch area as 'the most picturesque I had seen in the vicinity ... altogether far beyond the painter's art'^{2(p.68)}. It took more than a century for the connection to be made and converted to reality. Sadly, for reasons that are not clear, Burchell's portrait no longer hangs in the Compton Library at Kirstenbosch, where it is now stored in the archives.

Although not medically qualified, Burchell applied his knowledge of the medicinal properties of plants. He was the first to treat a serious condition by integrating traditional medicines of the Khoisan with western medicine; he treated successfully an accidental gunshot wound that mutilated the left hand of one of his assistants.²¹



Source: The Botanical Cabinet¹⁹

FIGURE 3: *Burchellia capensis* (Brown, 1820), now *Burchellia bubalina* (Sims, 1822).

The South African public mostly associates Burchell with animals, not plants: in the common names of a zebra (*Equus quagga burchellii*) and five birds – a coucal (*Centropus burchellii*), a coarser (*Cursorius rufus*), a glossy starling (*Lamprotornis australis*), a sand-grouse (*Pterocles burchelli*) and a crimson-breasted shrike, now gonolek (*Malaconotus atro-coccineus*, now *Laniarius atrococcineus*). Other less well known animals with common names after Burchell include Burchell's sand lizard (*Pedioplanis burchelli*), Burchell's redfin (*Pseudobarbus burchelli*), a critically endangered freshwater fish, two butterflies – Burchell's Yellow (*Colotis subfasciatus*) and Burchell's Brown (*Pseudonympha hippia*) – and Burchell's rhinoceros (*Rhinoceros simus*, now *Ceratotherium simum*), better known commonly as the white or square-lipped rhinoceros.

Earth sciences

John Barrow has been recognised as a self-taught geographer and geologist who made contributions to the fields in South Africa.²² However, Burchell has not been so recognised, although he made a number of novel observations and his map is a milestone in the history of cartography of the country.

It seems that his knowledge of and interest in geology grew significantly during his journey. His first geological notes were simply experiential: a description of the earthquakes that occurred in January and June 1811, while he was in Cape Town.^{2(p.157–160,p.169–170)} He was uncertain of the cause, but related that the 'phenomenon bore so much the character of electricity'. Burchell also noticed the granite on Cape Town's Lion Mountain; he only commented that it was much less abundant than the sandstone that formed the upper reaches of the mountains on the Cape Peninsula.^{2(p.29)} He did not explore the relationship or origin of the Cape granite that later interested Basil Hall and Charles Darwin.

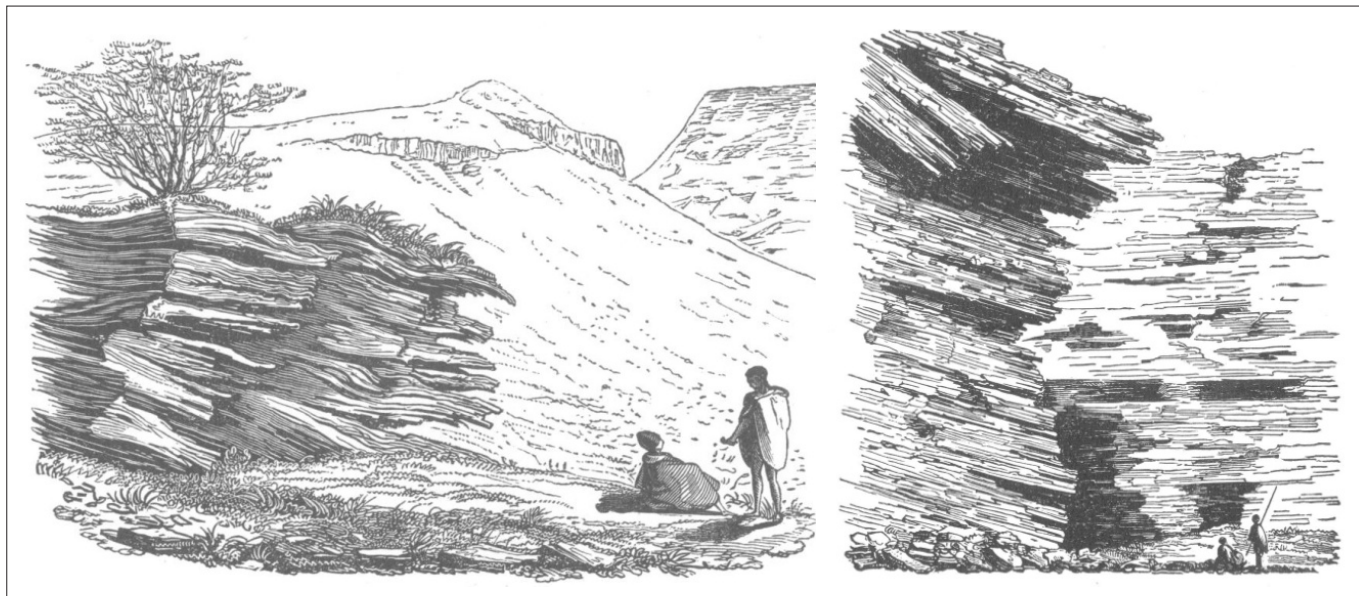
The discovery of asbestos in the Northern Cape is attributed to Henry Lichtenstein.²³ However, Burchell was the first to identify the mineral. In 1805, Lichtenstein took specimens south of Prieska, from 'a row of hills ... which appear to be composed entirely of a pale green, semi-transparent quartz'²⁴. Because he could not identify the mineral, he sent specimens to Martin Klaproth, the pharmacist and analytical chemist who published, in 1815, a short description of a 'new, non-fibrous, massive, blue mineral collected by Lichtenstein at the Orange River near Prieska'²³. However, Lichtenstein reported in his book an earlier publication which described the specimens; they were 'true fibrous quartz, which ... Klaproth ... described in the magazine of the Berlin Society's *Friend to the Inquirer into Natural History for the Year 1811*'. We have identified this article published by the *Gesellschaft Naturforschender Freunde zu Berlin*; the introduction to the 1811 volume is dated January 1812.²⁵ Klaproth proposed the name 'Blau-Eisensteins' (now, *krokydolith*, i.e. crocidolite).

A few months earlier, on 21 September 1811, Burchell was north of the Gariep River, in the hills that he named the Asbestos Mountains (Figure 4). Amongst the books Burchell took on his wagon was an unnamed volume on mineralogy; perhaps this volume helped him identify on the spot both asbestos and the derivative gemstones, Hawk's Eye and Tiger's Eye, which Lichtenstein had not mentioned:

The asbestos rock is formed of primitive argillaceous schistus, or clay-slate ... the strata are undulated ... in other places generally flat. Between these the asbestos is found in alternate and parallel strata ... the fibres being perpendicular, or transverse, with respect to the layers. Between these laminae, a beautiful kind of stone is found, sometimes of a blue color, sometimes of a silky golden color ... cut and polished, this stone exhibits a very beautiful appearance.^{2(p.333–334)}

So, it seems that Lichtenstein was the first scientist to notice asbestos in the Northern Cape, but could not identify the mineral; Burchell was the first to identify asbestos, which he did on the spot, and to describe, but not name, the two derivative gemstones; however, the Lichtenstein/Klaproth discovery was published in 1812, a decade before Burchell's (1822).

It seems that Burchell also was the first to describe glacial pavements in the country, but was unsure of their genesis. He experienced 'violent jolts' of his wagon while traversing 'a natural pavement of solid unyielding rock' between Klaarwater and the Vaal River and again north of Blink-klip (i.e. Postmasberg):



Source: Burchell³

FIGURE 4: Burchell's Asbestos Mountains (with his aptly named *Acacia detinens* on the left).

The rock was of a brown color, and seemed outwardly as if scoriated ... it was certainly not volcanic or changed by the action of fire ... a primitive limestone ... in many parts coloured by some ferruginous property ... in other places ... a coarse blueish-black cherty flint.^{2(p.338),3(p.260-261)}

He noticed numerous *koppies* strewn with (dolerite) boulders in the Northern Cape, north-east of today's Britstown, near where the N12 now crosses the Brak River, and elsewhere.^{3(p.34-35)} He incorporated the boulders and a nearby natural sandstone obelisk in one of his landscape paintings (Figure 5).

Amongst the rocks in the same hills, and also north-east of today's Sutherland, he found lithophones 'composed of a very hard and compact kind of Primitive Greenstone'^{2(p.277-278),3(p.43-45)}. He reasoned they had a high iron content; because of their effect on his compass.

Burchell also vividly described puddingstone *substrata* and lose rocks in and near the Gariep (Orange) River, between today's Douglas and Prieska.^{2(p.398-399),3(p.9-10)} He explained that 'the neighbouring hills and rocks evidently supply the component



Source: Burchell³

FIGURE 5: Burchell's boulders and obelisk.

fragments ... and the calcareous nature of the waters, together with particles of limestone ... form their mortar.'

Burchell described specularite (his '*sibilo*', the crystalline haematite) in more detail than Somerville and Truter and also Lichtenstein.^{3(p.256-258)} He documented its traditional mining and uses by indigenous people for adornment. He also described ironware and thought, correctly, that the region, about and to the north of what is now Postmasburg, was rich in iron ore. He recommended that the government employ a mineralogist to explore the mining potential of the country 'to bring to light ... it[s] sleeping riches'^{2(p.97)}, but it was more than a century later that the iron ore potential of the region was appreciated.

He was probably the first to describe 'the geology of the Transgariepine' and its ancient basement rock:

a compact limestone-rock of primitive formation [that] lies everywhere in a horizontal position [and] probably forms the foundation of the whole land of the Transgariepine ... the great floor, upon which all the mountains are placed ... and a superstratum of sand forms those immense plains.^{3(p.311-312)}

Burchell speculated on the abundance of some of the springs he observed, such as the Eye of Kuruman, and their relationship to the substratum of compact rock that he had described. He was not the first foreign visitor to the Caledon and Brandvlei hot springs. He did not speculate on their origin, but did not support the volcanic theory. He may have been the first to record accurately the water temperature of the Brandvlei spring (now within the grounds of the Brandvlei Prison): '62¼° Centigrade', but he suggested it might be a few degrees hotter 'where it bubbles from the earth'^{2(p.124)}.

Burchell charted his entire route.²⁶ He described in considerable detail his cartographic methods and also published much of his primary data. He recorded very accurately the latitude of many 'places along the road' and



also the longitude of all of his principal stations. He did not have a suitable chronometer for determining longitude and, while he used astronomical methods, he preferred the dead reckoning method. As did all pioneer travellers in the first half of the 19th century, he overestimated his eastern longitude the more north-east he travelled. There are numerous theoretical reasons for the apparently cumulative error, which diminished on the return trip, but one has yet to be published that explains it quantitatively.

Burchell's enormous manuscript map (2.9 m x 3.3 m) was reduced to 1/16 to produce 'A Map of the Extra-Tropical Part of Southern Africa' that was published in Volume 1 of his book.² The map influenced reputable map publishers such as the second generation of Arrowsmiths, the Society for the Diffusion of Knowledge, James Wyld and Sydney Hall.²⁶

Burchell's contribution to the earth sciences in South Africa extended beyond geology and cartography to other facets of geography. Throughout his book, he describes the topography and hydrology along his route. He kept meteorological records and provided numerous vivid descriptions of the climate and atmospheric conditions. Frequently, he commented on agricultural practices and saw numerous commercial opportunities. He contributed to the toponymy of the places he visited, preferring indigenous names, which he used in his text and maps (e.g. Gariap River instead of Orange). He also named and described ten geographical regions within the limits of his map.^{2(p.580-581)}

Philosophy

George McCall Theal noted that Burchell was a philosopher.¹⁰ Such a classification would not be appropriate for the earlier explorers of the country, so it is interesting to identify aspects of Burchell that made him different. On many occasions in the narrative of his journeys, he injects creative comments that address a wider vista than the immediate surroundings.

He considered matter, life and death and also the inter-relationship between animals and plants. He visualised a cycle of organised matter 'through the whole system of living objects' and 'a successive destruction of life':

It is evidently the law of Nature, that matter once made capable of life, shall never cease from the same duty; it is equally so, that animal bodies shall receive no nutrient but from organised substances ... in one body life must cease or be destroyed, before another can obtain that species of food which its conformation renders necessary.^{3(p.327)}

In his assessment of the place of mankind in nature, Burchell gave a hint of what has become the clarion call of modern conservation and environmentalism: 'Each animated object submitting to its superior; and all to man. In him terminates this scale of rapine and destruction; in him this graduated tyranny reaches its height'.^{3(p.328-329)}

Burchell's consideration of life on the African veld included a prescient statement on open systems and holism.

'We often remain totally ignorant of the proportions and perfect symmetry of the whole. In the wide system of created objects, nothing is wanting, nothing is superfluous: the smallest weed or insect is as indispensably necessary to the general good, as the largest object we behold. Each has its peculiar part to perform, conducive ultimately to the well-being of all. [...] Thus we see, throughout the whole system of nature, all things connected together, and necessary to each other's existence; useful in life, and useful in death ...'^{2(p.226),3(p.328)}

It is tempting to suggest that, a century later, Burchell's philosophical considerations inspired Eugene Marais and Jan Smuts, two South Africans who made seminal contributions to our understanding of systems.^{27,28} Hutchinson, who knew Smuts well, also thought the above lines of Burchell 'savour of holism'.^{18(p.126)}

Burchell was on a course towards and tantalisingly close to evolution, but the destination eluded him. Consider, for example, Burchell's thoughts on the protective value of the colour in some species.^{2(p.310-311)} He discovered a species of *Lithops* (which he identified as *Mesembryanthemum turbiniforme*), the colour of which resembled the stones about it: 'this juicy little *Mesembryanthemum* may generally escape the notice of cattle and wild animals.' He noticed nearby a slow-moving cricket, 'a species of the *Gryllus* tribe', the colour of which also was similar to the stones. He concluded that the 'intention of Nature' was to impart colour 'in order to compensate for the deficiency of its locomotive powers', that it 'may pass unnoticed by those birds, which otherwise would soon extirpate a species so little able to elude it[s] pursuers'. Darwin considered Burchell's book important enough to include it in his library, possibly also on board HMS *Beagle*.²⁹ Darwin met with Burchell, who also attended the meetings of the Linnean Society and the Society for the Advancement of Science at which the theories of Darwin and Wallace were presented and debated. At the time of writing his book, Burchell conceived nature as the divine creation of an immutable system that was in dynamic equilibrium. Unfortunately, we have been unable to find a record of Burchell's views on evolution.

Understandably, water was top of mind throughout his trek. He considered both the origin and flow of rivers and the springs in semi-desert areas. He also noted the large inland salt pans in the Transgaripe and proposed that rain water must flow through 'a stratum of rock-salt' that imparted the salinity.^{2(p.299)} Sitting by the banks of the Vaal River in 1811, Burchell reasoned that the large quantity of flowing water could not come from the local arid region and must therefore arise in some unknown mountains.

There is, it must be acknowledged, some presumption in thus pronouncing the nature of a country never yet visited by any traveler; but as we are living in the age for hypotheses in geography and natural philosophy, the presumption will appear less remarkable; nor indeed do I much care whether this hypothesis be hereafter proved or disproved, if it do but excite the curiosity of some properly qualified traveller to explore that region.^{2(p.443)}



Burchell's application of inductive philosophy (and altruism) may seem commonplace today, but was typical of the state of philosophical enquiry that was about to lead to the influential books by John Herschel³⁰ and William Whewell³¹.

Burchell touched on his philosophy of science. He favoured 'unprejudiced investigation of the facts' in favour of 'wild speculations and unfounded theories'; but accepted that 'there are bounds by which the universe of ideas is limited'^{2(p.97)}. Burchell had a liberal view on access to his scientific information, specimens and ideas. He hoped that others would find them useful and also detect and correct his errors. It was only after his return from Brazil that he failed to publish his findings and became protective of his specimens, even refusing access to Joseph Hooker, William Hooker's son, who succeeded his father at Kew.

Engineering, mathematics and astronomy

Burchell was competent in aspects of practical mechanical engineering. He designed, described in detail and drew to scale his unique modification of the Cape ox-wagon (Figure 6).^{2(p.149-152,p.171)} Because his custom-made wagon was overloaded, he bought a traditional Cape wagon in Tulbagh and, for almost 4 years, the two wagons were his mobile home, laboratory, library (of more than 50 books), art studio, warehouse and, occasionally, a place for entertaining guests.

Burchell also maintained and repaired his wagons during the trek. He explained how the dry heat of the interior caused the iron tyres of the wagon wheels to expand and the wooden fellys to contract. To fill the gaps, he inserted wooden wedges, which he had to remove on his return, as he got closer to the coast.

Burchell was qualified to teach mathematics on St. Helena and, while he made no novel contributions to the subject, he applied his knowledge effectively in celestial and dead reckoning navigation and in cartography. Figure 7, from one of his pocket sketch books, shows his trigonometric method for determining the width of rivers such as the Gariep and Ky-Gariep (his Yellow River, now the Vaal).

While on St. Helena, Burchell taught himself astronomy and made observations of the southern skies. He appreciated astronomy's value to travellers in unknown territory and had a copy of *Atlas Céleste de Flamsteed* in his wagon. His observations were made with a simple, hand-held telescope (Figure 2) and a good quality sextant and, on experiencing the African nights, he lamented that he did not have an astronomical telescope.

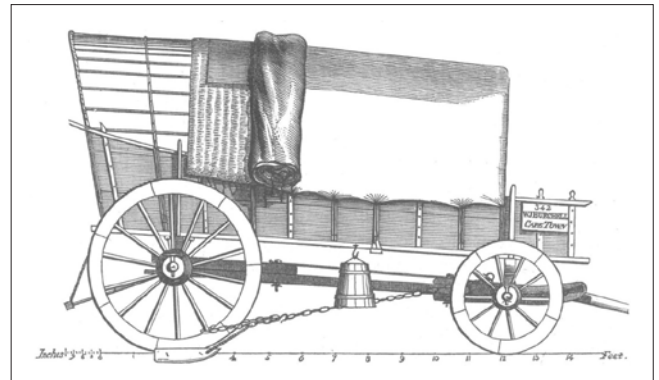
Burchell's contribution to astronomy was modest. He observed the Great Comet of 1811 in Cape Town, which he recorded to have been visible from 12 May.^{2(p.160)} On 4 November 1811, while at the Ky-Gariep River, he observed another comet. It was near the tail of Aquila: 'α Cygni, α Lyrae and the comet forming a right-angled triangle'^{2(p.431)}. On 22 November 1811, Burchell's comet disappeared from sight at

Klaarwater (Griquatown). However, Burchell is best known to astronomers for his observations of the variability of the brightness of Eta Carinae.³² In 1845, Burchell wrote a letter to the astronomer Manuel Johnson, later communicated by Sir John Herschel, recording that, when he was in South Africa, Eta Carinae's brightness was of the fourth magnitude; however, in 1827 and 1828, when he was near São Paulo in Brazil, he observed that its brightness had increased to at least the second and possibly the first magnitude.

Social sciences

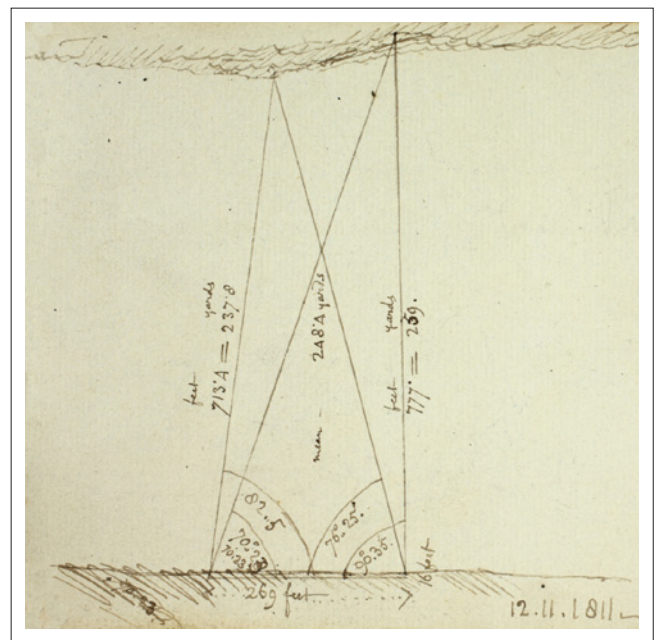
We agree with Bugliarello that it is more useful to search for the confluences of the sciences, engineering, the humanities and the arts than the schisms.¹ Burchell seemed to have had little difficulty finding the zone of confluence.

Like Robert Gordon and Johann Forster, Burchell was an accomplished linguist. As did other travellers, he left us a glossary of the words he used in the Kora (!Ora) and



Source: Burchell²

FIGURE 6: Burchell's ox-wagon.



Source: Museum Africa: MA1968_1464_30B

FIGURE 7: Burchell's determination of the breadth of the Vaal River near its confluence with the Modder River.



'Sichuána' (Setswana) languages. However, Burchell was different; ever the scientist, he developed an orthography of the languages.^{2(p.252,p.295-297,p.307-309)}

Despite his command of languages, Burchell's preferred medium of communication was drawing and his collections were augmented by numerous, excellent drawings of plants and animals. In his youth, Burchell received formal training in landscape drawing and draughtsmanship. While in southern Africa, he drew a plan of Cape Town, landscapes, local buildings, some of the people he met and travel scenes. Helen McKay edited the scarce publication of a selection of his drawings,³³ the majority of which, including his pocket book sketches, are conserved at Museum Africa.

On his travels, Burchell embraced indigenous dyes in the manufacture of paints and ink. While on his African trek, he produced a metal-based paint from *sibilo*.^{3(p.256-257)} He also developed a long-lasting, bright yellow ink and paint from plants of the *Thymelearum* (*Thymelaecae*) family.^{2(p.212)} While he was en route to Graaff-Reinet, his assistants shot a black rhinoceros (*Diceros bicornis*). As his writing ink had dried up, Burchell wrote his detailed morphological descriptions with an ink he made from the animal's blood.^{2(p.75)}

While Burchell has not been considered a creative artist, his drawings are aesthetically appealing (Figure 8).

Burchell explained the method he applied for drawing perspective, which is rooted in the geometry of cylinders.^{2(p.448-449)} The excellent perspective and aesthetics have prompted research, by a Paul Mellon Research Fellow, an architect from Brazil, on 'The Landscape Art of William John Burchell' at the Center for Advanced Study in the Visual Arts at the National Gallery of Art, Washington, D.C.³⁴ His contribution to art in Brazil is described as 'supreme among those who best depicted our architecture'³⁵.

Burchell was a useful ethnographer, whose contributions are captured both in his text and drawings of people (Figure 9), their dwellings and artefacts.

Burchell's command of English was a great asset. His ethnographic notes by far exceeded the accounts of his predecessors. In his 'Introduction' to the 1953 reprint of Burchell's book, Schapera pointed out Mendelssohn's assessment of the book as:

the most valuable and accurate work on South Africa published up to the first quarter of the nineteenth century; he far surpasses any other writer of his time. He is outstandingly successful in describing the character, both of individuals and of peoples generally ... His verbal sketches ... are among the most effective passages in his book, and do more to help us understand such people than would have been achieved by a bare catalogue of their tribal manners and customs.³⁶

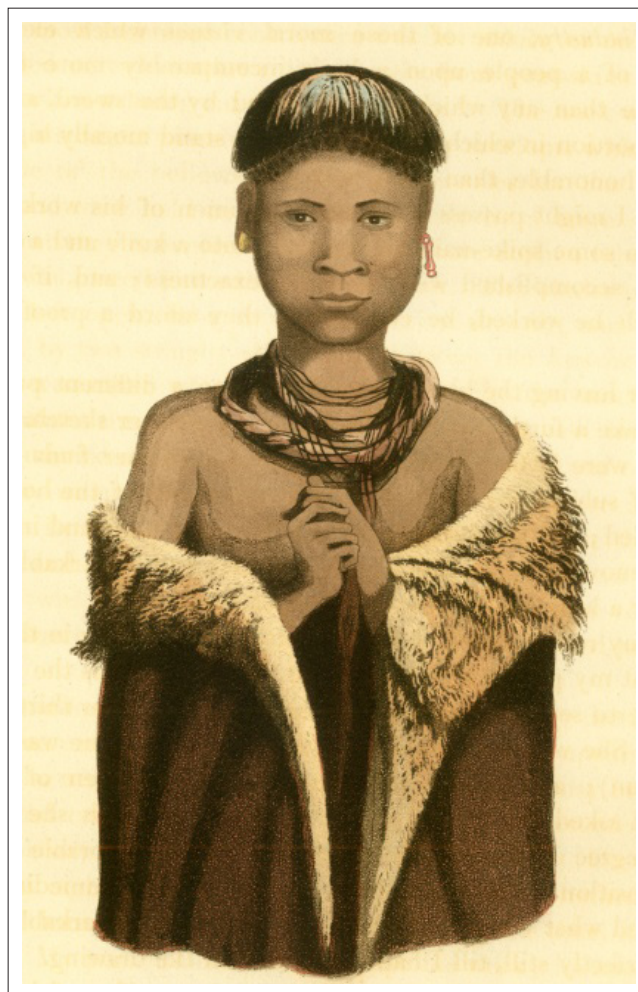
Burchell played a reluctant role in the colonial expansion of England. His extensive experience of South Africa led to his being questioned in 1819 by a Select Committee of the British House of Commons. The committee was investigating the suitability of South Africa as a destination for emigration.

Burchell published a 48-page pamphlet incorporating some of his responses to the committee, which was followed by the subsequent waves of Settlers to the Cape, commencing in 1820.³⁷ It is this publication that precipitated the conflict with Barrow.^{4,5,6} If only they had joined forces ...



Source: Burchell²

FIGURE 8: San village on the banks of the Gariep River (Burchell 1822).



Source: Burchell³

FIGURE 9: Portrait of Massisaan (M|ssis~n, using Burchell's orthography), who 'presented a good specimen of Bachapin beauty ... and the peculiar manner in which the females of this tribe twist their hair so as to give it the form of a cap' (Burchell 1822).



Conclusion

We have explored some less well recognised products of Burchell's African journey 'in search of knowledge'. In the process, we came to appreciate that Burchell put into practice a modern *trivium* and *quadrivium*.¹ The *Dictionary of South African Biography* praises Burchell:

His work as a naturalist has never been equalled. His careful preparation, execution and completion of his objectives, detailed annotation and brilliant appreciation of nature set science a goal seldom achieved. Much of what he discovered has enriched the work of others.³⁸

William Swainson lamented that 'science must ever regret that one whose powers of mind were so varied ... was so signally neglected in his own country'³⁹.

The 200th anniversaries of Burchell's arrival in Cape Town (26 November 1810) and departure for his 46-month trek (19 June 1811) passed virtually unnoticed.⁴⁰ The 14 April 2015 will be the 200th anniversary of his return to Cape Town on ox-wagon and the 25 August 2015 the anniversary of his departure for England.

Let us hope that William John Burchell will not be 'signally neglected' by the South African science community during the bicentenary of his scientific exploration in our country. He is worthy of our memory.

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Competing interests

We declare that we have no financial or personal relationships which may have inappropriately influenced us in writing this paper.

Authors' contributions

Both authors have studied WJ Burchell, contributed to the content and consented to co-authorship.

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