

CHAPTER 13

NAMIBIA – A Long-Term Global UNESCO IGCP Project – In Search of Animal Beginnings

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with

Guy Narbonne, Jay Kaufman, Charlie Hoffmann, Andrey Ivantsov, Kombada Mhopjeni & Helke Mocke



A classic T-shirt organized by Jay Kaufman, based at the *University of Maryland* in the USA – a member of the *UNESCO IGCP* Projects 495, 587 and 673 teams who have been investigating the Nama Group sequence in southern Namibia for more than 2 decades. (Art by Peter Trusler; Photo by Steve Morton)



Southern Namibia, a land of great beauty that hosts a record of a time around 538.6 million years ago when life on planet Earth changed from a weird assemblage to one common today. (Photo by P. Swinkels)

Where Did the Namibian Adventure Begin? A Building Launch and a Research Conference

As with so many adventures, that in Namibia began with a *meeting of the minds*. After a decade of chasing funding to construct Building 74 on the *Monash University Clayton*

Campus in which to house the *Monash Science Centre*, the time came for the launch of this beautiful new structure. Because of the ongoing relationship between the Monash team and the *Paleontological Institute* (PIN) in Moscow connected to *The Great Russian Dinosaurs Exhibition* (GRD), Pat, of course, invited two research colleagues to the launch of this new building, and the beginning of another phase in the history of the MSC.

Prof Yoshikazu Hasegawa, Head of the *Gunma Museum* in Japan and Dr Alexei Rosanov, Director of the *Paleontological Institute* in Moscow, were top of the list. Both were there for the launch. Hasegawa had been fundamental in introducing Pat (and her daughter Leaellyn) to what became *The Great Russian Dinosaur Exhibition* in Japan when they were attending the *International Geological Congress* in Kyoto. Hasegawa had insisted that Pat go to Tokyo and see the exhibition of Russian material on display there. Once she viewed it, she began a journey that led to the GRD expo. She returned to Kyoto where she met Alexei Rosanov, and, from that brief meeting in August 1992, the GRD was born and opened in Australia in August of 1993 – one year later! The speed with which this was organized was quite phenomenal, and possible because of the near absence of Red Tape!

During the negotiations in May of 1993 in Moscow, which involved Rosanov along with his team, Pat, Chris Tassell from the *Queen Victoria Museum and Art Gallery* in Tasmania, Tom, along with two staff from the *Museum of Victoria*, photographer Frank Coffa and an administrator David Smith. Pat met a number of PIN staff including Mikhail (Misha) Fedonkin, whose main research interest was the Precambrian. Pat's main research with the PIN staff up to that point, and beyond that for a number of years, centred on fossil birds. But she and Fedonkin continued to correspond over the years, and at the time of the launch of the MSC's Building 74, he and some others of the PIN staff visited Australia to attend this event. Fedonkin travelled to Melbourne for the launch and presented a number of lectures centred on the Precambrian – and Pat was fascinated by the research that he and his team were pursuing.

From that point, Pat and Misha began thinking about writing a book, and perhaps putting together an exhibition, which eventually led to field work, cooperative research and the publication of *The Rise of Animals* in 2007. The ideas for that all of that, especially the book, came up on the 30th of August 2002 – a date that is well remembered by both.

Field trips quickly were put into action with one planned to the White Sea in the summer of 2003, which involved not only Pat but also Peter Trusler, Tom Rich and Jim Gehling, a well-known Precambrian geobiologist from Australia – famous for his work in the Flinders Ranges. The following September Fedonkin returned to Australia and together with Pat and Frank Coffa (and his partner Mena) were hosted in the Flinders Ranges by Gehling. Tanya Tumanova, Misha's wife, was also able to visit Australia that year to pursue her interests in dinosaurs. Tanya, Misha, Tom and Pat were able to visit and experience the Great Barrier Reef at the end of the year.



Left. Art showing the Ediacaran fossils (as found in the field) in the lower part of the painting and their reconstructions above. Right. The site in the Flinders Ranges of South Australia where such Ediacarans were discovered. (Art by Peter Trusler)

The most important event of that year, however, was the attendance of a meeting in Cape Town, South Africa followed by a post-conference field trip that took Pat and Misha to Namibia – from 22 October to 5 November 2002. It was on that field trip that they crossed paths with a number of colleagues, and those linkages have led to the three UNESCO *International Geoscience* Projects 493, 587 and currently IGCP 673, which have targeted the Vendian/Ediacaran late Precambrian biotas of Russia, Australia, Newfoundland and perhaps the most unexplored at that time, Namibia.



Field conference after meeting in Cape Town, a joint trip of the *UNESCO International Correlation Projects* 478 and 493 visiting the Neoproterozoic sections in South Africa and Namibia, in 2002, led by Claudio Gauchier (second from right, kneeling) from Uruguay, which included Precambrian and Cambrian researchers from around the world. In the back row and second and third from the left are Charlie Hoffmann and Mikhail Fedonkin, with Pat on the far right. Kneeling in the front row on the far right is Florencio Acenolaza from Argentina, who along with his son Guillermo, later hosted Pat and Fedonkin to investigate the late Precambrian sequence in the northwest of that country – the Puncoviscana Formation cropping out in the high Andes. Hartwig Frimmel in the back row 5th from the right, was a co-leader with Gauchier of this

trip. The Cambrian sequence of rocks in the background at Fish River Canyon, southern Namibia. (Photo organized by P. Vickers-Rich)



The T-shirt that was provided to each of the participants at the Cape Town conference. After the conference Pat and Misha travelled to Namibia, which was the beginning of a long-term UNESCO International Geoscience project investigating the origin of animals. (Photos by Steve Morton)

The field trip investigating the late Precambrian and Cambrian sequences in Africa began in Cape Town. Following the main road north from there, and a few side roads, the end of this field trip was Namibia. On that trip, once in Namibia, Pat first met Barbara Boehm-Erni when visiting the fossil site of Aarhauser on Farm Aar near the town of Aus. There an abundance of *Pteridinium* fossils had been discovered in the early 1900's and long studied by Adolph Seilacher and his team from Germany. It was a site that had been visited time and time again but prospecting had not moved far beyond the initial site. When Pat and Misha took a look around and beyond that place, it seemed clear to them that the entire country around this spot should be searched for further material – and with that began a project that would last for decades and still in progress.

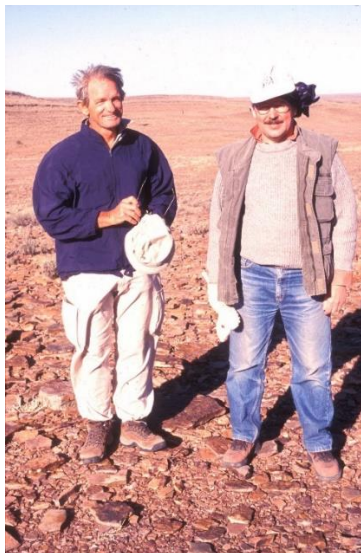


Outcrops of the Nama Group in southern Namibia. The exposure and the length of time represented in these rock sequences give one of the best opportunities to determine just what happened to life on Earth across the Cambrian-Precambrian boundary some 590 to around 520 million years ago. (Photo by P. Vickers Rich)

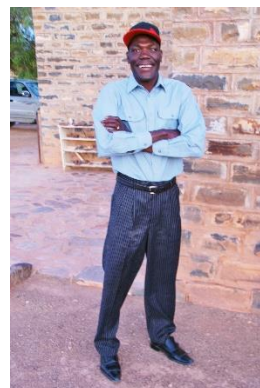
The Critical Importance of Contacts – Both Professional and Local

Critical to the further work, which has now spanned nearly two decades, was not only the meeting with Barbara Boehm-Erni at Aarhauser, but also the time spent on that field trip with Charlie Hoffmann and later the meeting with Gabi Schneider, both based at the *Namibian Geological Survey*. Charlie was Head of Mapping and Gabi the Director. Once the field trip ended, Misha and Pat caught a bus to Windhoek where they spent some days at the *Namibian Geological Survey* examining the collections. They were able to meet with the staff at the Survey and discuss future work in this very promising landscape.

What resulted from the contacts made at that meeting were three *UNESCO International Geoscience Projects* – 493, 587 and now 673, the latter ongoing – which led to field trips in Russia, Australia, Newfoundland and Namibia, as well as a number of other meetings and publications, including two lengthy books. Add to that, exhibitions and children’s literature, postage stamps and documentaries. Again, it is truly amazing how a single event can generate so many ongoing outcomes and long-term friendships.



Left. Charlie Hoffmann, from the *Namibian Geological Survey*, on the left, with Mikhail Fedonkin. Right. Slabs used to construct ceremonial structures atop one of the many high points in southern Namibia. Such slabs often contained the fossil remains of the ancient Ediacarans. The remains of a Quiver Tree is in the background. (Photographs by P. Vickers-Rich)



Left. Barbara Boehm-Erni and Bruno Boehm on Farm Aar. They were the owners of this property that hosts a wealth of Ediacaran material. From the very beginning of Fedonkin's and Pat's work in the area they provided considerable assistance and a home for the many field expeditions that have worked in this region of Southern Namibia near the town of Aus. Bruno most sadly passed away, but now in 2021 Barbara is still on the farm and as always supports the field teams who work in this region. Right. Saki, the Hired Hand in charge over many years of helping mind the farm and most helpful to the team of researchers working on the property. (Photos by P. Vickers-Rich)

Once Fedonkin and Pat had attended that meeting and decided to source funding to continue detailed work in Namibia, they applied first to UNESCO for an International Geosciences grant (IGCP). They were successful in obtaining IGCP493, which continued for several years. This project brought together a variety of researchers already working on the late Precambrian, and this continues to date. These colleagues came with a variety of specialties – stratigraphers, geochemists, geochronologists and even palaeontologists! They came from around the world, with many based in Namibia itself and with long experience in this landscape.



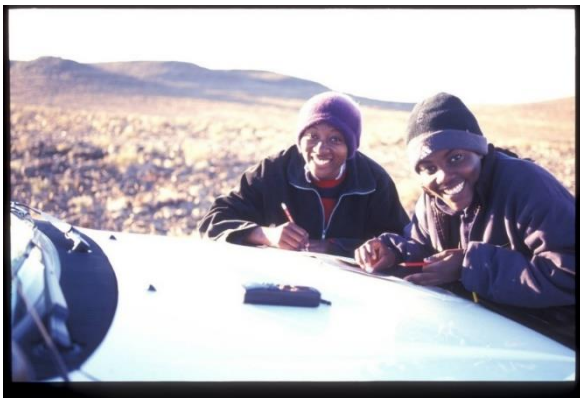
Left. Guy Narbonne (palaeobiologist) from Canada in front with Jay Kaufman from the USA (geochemist). Middle. Ulf Linnemann (geochronologist), Ines Linnemann and Jens Ulrich from Germany. Right, Jeff Smith (mapper and horticulturist) from Australia. (Photos in Middle and on Right by P. Vickers-Rich)



Left. Steve Pritchard (documentary producer) with Barbara Boehm-Erni. Right. (l-r) Chia-wei Li (palaeobiologist) from Taiwan, Barbara Boehm-Erni (landowner) from Namibia, Guy Narbonne (palaeobiologist and geologist) from Canada, Mike Hall (stratigrapher) from Australia and Andrey Ivantsov (palaeontologist) from Russia. (Photos by P. Vickers-Rich)



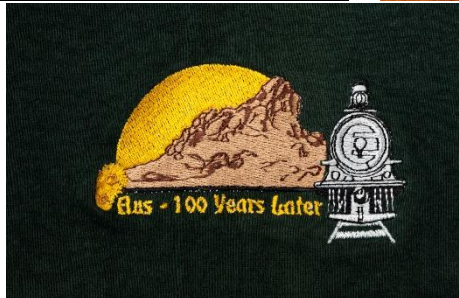
Left. Left to right: Andrey Ivantsov (and his friend), owners of the Scheidhof Guest House to the east of Windhoek, Jeff Smith, Les Kriesfeld and Tom Rich in 2015. The team was exploring the older sequences in this area for the first time and although it was a promising area, they have not yet been able to return. Right. Peter Swinkels entering data on field localities. (Photo on left by P. Vickers-Rich; photo on right by Helke Mocke)



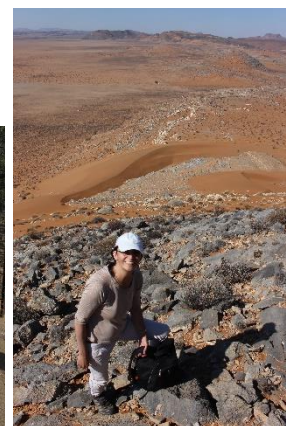
Left to right, Ahihe Kavela and Kombada Mhopjeni, two staff from the *Namibian Geological Survey* who worked with Misha and Pat in some of their early surveys of the Nama Group rocks. (Photo by P. Vickers-Rich)



Left to right: Kombada Mhopjeni and Helke Mocke in the Nama Group on Farm Pockenbank, southern Namibia, both based at the *Namibian Geological Survey*. Helke Mocke's encounter with Pat's Australian team in the field in Namibia has been one of mentorship and learning about these fascinating animals and how they got preserved. From this field knowledge she was able to guide a field excursion on Farm Aar in southern Namibia, as part of the 50th Anniversary Conference of the *Geological Society of Namibia* in 2019. (Photo by Helke Mocke)



Left and Below. T-shirt from the Bahnhof Hotel in Aus. The owners of this hotel, Bernd and Lela Roemer, have been fundamental to the success of the *UNESCO International Geosciences Program projects 495, 587 and 693* by providing so many things: accommodation, food, access to properties and a sustained friendship over decades. Without their assistance and that of Barbara Boehm-Erni and Bruno Boehm, so much less would have been accomplished. (Photos by Steve Morton) Right. Bernd Roemer, owner of the Bahnhof Hotel in Aus, and a true field assistant in accessing properties and providing historical knowledge for the lands our team explored. (Photo by P. Vickers-Rich)

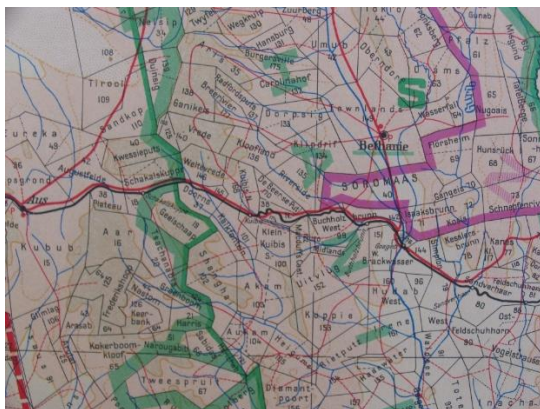


Left. More of the teams that have been deeply involved in the IGCP493, 587 and 673 projects in Namibia. Left. The Dresden (Germany) Geochronology Team led by Ulf Linnemann. Left to right: Rita Krause, Johannes Zieger, Ulf

Linnemann, Jessica Gartner and Mandy Hofmann. Middle. Peter Trusler on left, Ulf Linnemann and Pat on Farm Aar. Right. Maria Ovtcharowa from the *University of Geneva*. (Photos provided by Ulf Linnemann)



Farm Aar land – a quiet and stunning landscape. (Photo by P. Vickers-Rich)

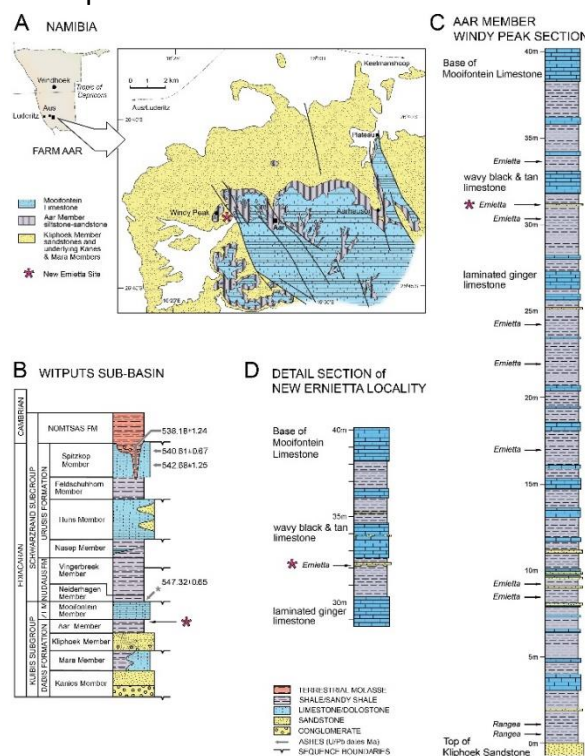


Left. Map showing the location of Farm Aar. Right. The homestead of Farm Aar from atop the limestone plateau that surrounds this region. (Photos by P. Vickers-Rich)



Home for the Ediacaran hunters who have taken part in UNESCO IGCP Projects 493, 587 and now 673 – the old farmhouse on Farm Aar in southern Namibia. (Photo from Erni-Archives)

Of all the activities that developed from that 2002 meeting in southern Africa, one stands out and that is the exploration of the Precambrian/Cambrian sequences in southern Namibia. Farm Aar became the focus of these projects, but further field exploration was carried out to the east and south of that farm – on Farm Pockenbank, Farm Swartpunt, Farm Arasab (especially the Theodora section) and others. Farm Aar was the most prospected, and new sites and spectacular fossils were recovered, some for the first time in 3 dimensions. The collections in the *Namibian Geological Survey* in Windhoek were increased hugely – and Pat and her Australian team with colleagues from Russia, the USA and Canada were able to secure funding to purchase additional storage cabinets to house the materials that they kept finding each trip.



Stratigraphic sections and maps for Farm Aar prepared by Mike Hall, the head geologist for the field team under the UNESCO grants 493, 587 and 673. (Photo by Steve Morton)

Detailed mapping of the entire region was carried out by such team members as Prof Mike Hall's and Pat's students, including Les Kriesfeld based at *Monash University* in Australia. Sampling this region for geochemical analyses, coordinated with Mike Hall's mapping was taken on by Prof Jay Kaufman and his student Huan Cui from *the University of Maryland* in the USA; radiometric dating was coordinated by Prof Ulf Linnemann and Mandy Hofmann and their team from Dresden Germany. The date now accepted for the Precambrian-Cambrian boundary in the latest *Geological Time Scale (2020)* is that from the Swartpunt section in southern Namibia based on Linnemann's team at 538.6 million years ago. As part of the three UNESCO projects, more than 150 researchers have participated, and many are still part of UNESCO IGCP673.



Left. Peter Trusler (seated) with Mike Hall on the Farm Aar porch crafting another of his many artworks, this of an aardwolf that we found along the gravel road en route from Windhoek – the poor fella had been hit by a passing car. Peter decided to immortalize him. Right. The front room of the house on Farm Aar where field crews working with Pat spent several months – where Peter carried out his art, which also served as an office for the team members, and a place for dinner when the work was done for the day. A small exhibition is emplaced there now about the fossils from Aar. (Photos by P. Vickers-Rich)

Namibia, Southern Africa

"Namibia has many features to be admired and appreciated: spectacular scenery, abundant wildlife, people diverse in culture and outlook, a sunny climate" (Atlas of Namibia)...and brilliant geology that is exposed over broad tracts of land. In this land of sand and spectacular landscapes the fossil remains of some of the world's first animals are embedded, known since World War I when German soldiers found odd shapes in the rocks.

Since the early part of the 20th century impressions of animals which had no hard parts have been known in Namibia, some of them collected in the early days by the German soldiers who remained in the name of the most isolated parts of the country.

Impressions of a variety of animals, some of the first on Earth, are found in the sandstones and claystones of the Nama Group. (350 million years old). These rocks represent deposits in a shallow, ancient sea, the Albatrazian Ocean, which lay between three cratons of Gondwana – the African, South American, and the North American cratons. To the south, the Kalahari Craton – southern Namibia and South Africa. This sea covered the 500 million years ago, and these continental masses added to form the great southern continent, Gondwana.

Many of the animals which left these impressions are similar to those found elsewhere in the world, and some are entirely unique to Namibia. *Pteridinium* is common in Namibia and also along the White Sea coast in Russia, most seen in Australia, North Carolina, and Newfoundland.

What *Pteridinium* was and how it lived, is debated. Some paleontologists, Ben Motzinger for example, was suggested it was related to corals. Others, David Salsbery, think it belonged to a group called the spongiolites, which left no long tracks. It appears to have a flat base like a rock, but it is together. Perhaps corals form a hard mass and hold up a feathery part out of the water. Perhaps *Pteridinium* lived with the help of symbiotic algae dwelling in its leaves, partly buried in the sediments or attached to the bottom, and did not move around.

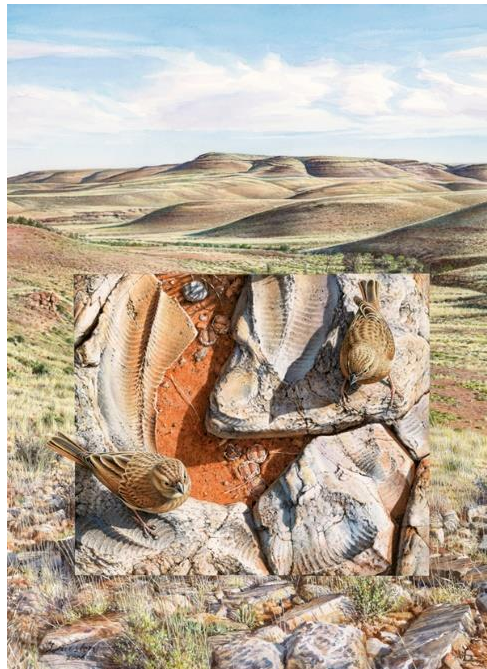
Pteridinium was a colonial form, or the flat, related to corals, which occurs in concentrated groups. Each one of the "units" may have housed a life polyp, just as in a modern coral colony. *Pteridinium* probably lived partially buried in the sediment with only its feathery colony protruding, though up in direct contact with the water. The original very likely formed from the surrounding sea water.

Range was an elongated form with a flat life configuration – probably being with its base attached to the sea floor and its feathery structure extending into the water. Its colonial nature and its body may be the soft tissue, the sea part.

Preserved in 1911 The German soldiers found odd shapes in the rocks. The fossils were first discovered in 1911 by German soldiers who were in Namibia during World War I.

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Farm Aar is also a destination for the environmental tourist. Early on, when Pat and her team were mapping and prospecting there, they set up a small exhibition in this original farmhouse using the art and photographs put together by Pat and Peter Trusler. Above is one of the several information panels and an art piece crafted by Peter Trusler, on show as part of the expo. Peter's art records, in the middle of the painting, a block containing the fossil material upon which two lark-like buntings, *Emeriza impetuani*, are perched. That block hosts the fossil *Pteridinium*, widely exposed in this area. Peter Trusler crafted this while sitting on one of the hills on the southern part of Farm Aar during one of his many visits there. In the painting, inhabiting the red sand between the fossils, are the living *Lithops* "living stones," which are rare and endangered plants. In the background is the landscape typical of the southern *lithops* of Farm Aar. (Photos by Steve Morton)

Why Is the Southern Namibian Rock Sequence So Interesting and Important?

Some text from an article, published by the *Namibian Scientific Society* based in Swakopmund (Namibia) in their *Reports*, volume 52 (1), which sums up the importance of the rock sequences in this part of Africa. (authors Vickers-Rich, Mhopjeni and Schneider et al, 2020):

*Namibia hosts a near complete sequence of sediments and volcanics that record a period from the late Neoproterozoic into the early Phanerozoic (600-500 million years ago) when the biota on Planet Earth changed from enigmatic life to life that we consider normal today, including the appearance of Animalia – forms with eyes, guts, the ability to move and even hard skeletons. Older rocks of this sequence contain biota dominated by the so-called Ediacarans, which lacked burrowers, depended greatly on massive microbial mats and chemistry of the surrounding ocean for nourishment, most of them lacked eyes, guts, and only few were able to move. All that changed when that **Line was Crossed** around 538-539 million years ago. Rocks in Southern Namibia host many of the possible answers to just what happened at this time, and researchers have over the past few decades been able to more precisely date just when this transition occurred and what were the environmental drivers to this change. Their research is showcasing early complex, megascopic lifeforms of the Ediacarans, some of which were predecessors of true animals. This research continues now with a global network of scientists continuing to add to the ever-increasing database, which is so critical to understanding the interaction of life and changing environmental conditions. This is also very relevant for predicting the future of Planet Earth.*

Namibia has been a key region for understanding some unusual organisms called Ediacarans since the early days of the 20th century, when geologists, such as Paul Range and German soldiers stationed at isolated outposts in the Aus region of southern Namibia, first reported strange fossils from there. These were the first large multicellular organisms that prospered on Planet Earth before the development of animals. Their fossils are preserved in the thick rock sequences of the Nama Group in southern Namibia and showcase a time in the history of life when there were fundamental and pivotal changes from an enigmatic biota to the biota we know today.

*The first formal name for one of these complex Ediacaran life forms was given by Gürich in 1930. He proposed the name *Rangea schneiderhoehni* for fossils of the enigmatic, cm-scale frond-like organism collected from the Dabis Formation in the south of the country. *Rangea* predated Sprigg's (1947) description of *Dickinsonia* from the Flinders Ranges in Australia by nearly two decades. *Dickinsonia* fossils also formed part of the Ediacara biota and the official name for this geological period is based on these fossils from Ediacara. Likewise, the official naming of other Ediacaran fossils in Ford's (1958) description of *Charnia* from Charnwood Forest in England happened nearly three decades after Gürich's seminal paper. *Rangea schneiderhoehni* was not a simple disc that could be described and then forgotten – it was a frond covered with features so complex that Gürich assumed *Rangea* must be of a younger Cambrian age, a time period well known by then, especially from rocks in England and Europe, that hosted true skeletonized animals – trilobites and shelled forms related to clams and snails.*

An intriguing question is what happened to the last of these first complex and large organisms that developed on Earth? Recent analyses by Darroch et al. (2015; 2018) illustrate that the latest Ediacaran communities preserved in the Nama Group were relatively species-poor, and perhaps already in the throes of an extinction event. This decrease in the diversity of Ediacara biota worldwide coincides with both evidence for regional anoxia (e.g. Wood et al., 2015), and the rise of more complex Cambrian-type behaviors and 'ecosystem engineering', providing potential support for competing environmental and biological drivers of extinction, respectively. Only more data and new fossil discoveries will allow us to test between these two models, and determine what eventually led to the disappearance of the Ediacara biota about 538-539 million years ago.

Intriguingly, a biological driver of extinction would raise uncomfortable parallels with the present day, where humans are altering our environment at a pace which threatens millions of species. In this fashion, this

supposed 'first mass extinction' and end of the Ediacaran may offer clues and an invaluable lesson for interpreting the present biodiversity crisis. In the future, such knowledge will surely be of fundamental value in using our understanding of what happened to the Ediacarans and the dynamics of the dramatic biotic change at the beginning of the Cambrian...and give much needed guidance on planning the future of humanity! Just how we use that understanding will most certainly be critical to our survival as a species. We just hope humanity listens!

Thus, because of the importance of this geological sequence, not only for understanding the past (but for planning for the future), projects IGCP493, 587 and 673 attracted a wide range of researchers who were willing to cover costs to take part in activities, including the Namibian work. Most importantly, they were also willing to provide access to their laboratories in order to analyse the samples collected for geochronology, geochemistry, micro- and macro-palaeontology and more. Several field conferences have been organized over the years by this group in order to bring together this broad research base so that they could discuss many issues on site, face to face.



IGCP 673 field workshop in March 2019 in the field in southern Namibia. Ulf Linnemann in the back row with thumbs up was the organizer of this activity. (Photo provided by Ulf Linnemann)

The Truly Important Role of the *Namibian Geological Survey*

All of this work would not have been possible without the cooperative arrangement set up with the *Namibian Geological Survey* (NGS) then directed by Gabi Schneider. She is now the Director of the *Namibian Uranium Institute*. Gabi has made the exploration and research of UNESCO IGCP 493, 587 and 673 feasible. Her interest has been not only in research and industry but also in public education, and that has led to all manner of connections for Pat and her teams. Results have covered a wide spectrum - exploration, discovery, and numerous publications for research, for the general public and kids – and exhibitions such as that on Farm Aar and with the Swakopmund Museum (see *Crossing the Line* in the Appendix).

Many of the staff at the NGS have been, and continue to be, part of the Ediacaran investigations carried out by Pat's IGCP teams – including Charlie Hoffmann, Helke Mocke and Kombada Mhopjeni along with other support staff. Were it not for their support and sharing of experience, along with the support of the local landowners and colleagues in the *Namibian Scientific Society*, this project that has spanned nearly two decades would simply not have happened.

Of course, the fossil material and selected geological samples collected on all of these expeditions become part of the NGS collections, and over the years many of the team have assisted with curation and documentation of these and previous collections. As part of this project, along with NGS staff, the team have raised funds to increase the storage capacity of the NGS collections, for those collection storage units have grown from 2 to more than **8 cabinets** (and growing).

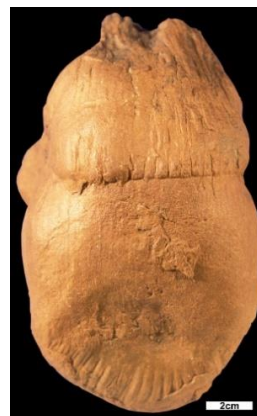


In order to house the collections that were made over the years of Ediacaran fossils from the Nama Group, more cabinets had to be added to the NGS facility in Windhoek. Funding was raised from many sources including the NGS and the IGCP493 and IGCP587 projects. (Photos by Helke Mocke)

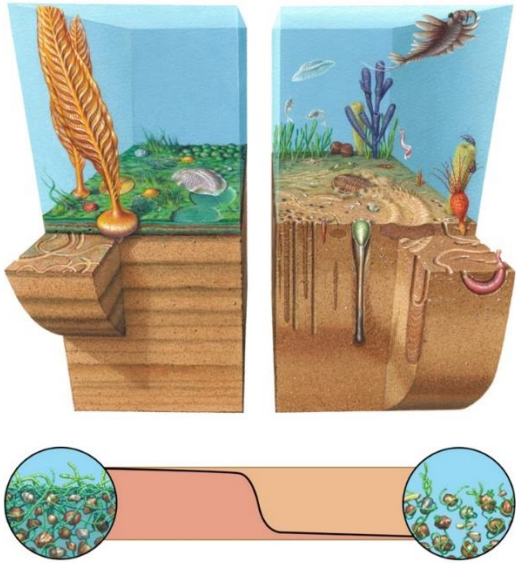
Clearly important in preserving this material is both the collection, storage and access to critical specimens, but also the effort being put into compiling a UNESCO World Heritage application so that many of the productive sites on such farms as Aar, Pockenbank, Arasab and Swartpunt can be protected. There has certainly been some fossil thievery taking place, on Aar in particular, where unique specimens that had been in place for decades are now missing.



Display case in the museum at the headquarters of the *Namibian Geological Survey* in Windhoek, with a variety of Ediacarans that occur in the Nama Group on show. (Photo by P. Vickers-Rich). The museum of *Namibian Geological Survey* also displays some of the best Ediacara examples from Namibia. "This display always grasps attention and visitors ask questions about these first multicellular animals, wondering at both their simplicity and complexity at the same time. The museum through Pat's collaborative efforts has provided specimens for an exhibition in the *Swakopmund Museum*, which is situated next to the Atlantic Ocean on Namibia's western Coastline." Helke Mocke. (Photo by Helke Mocke)



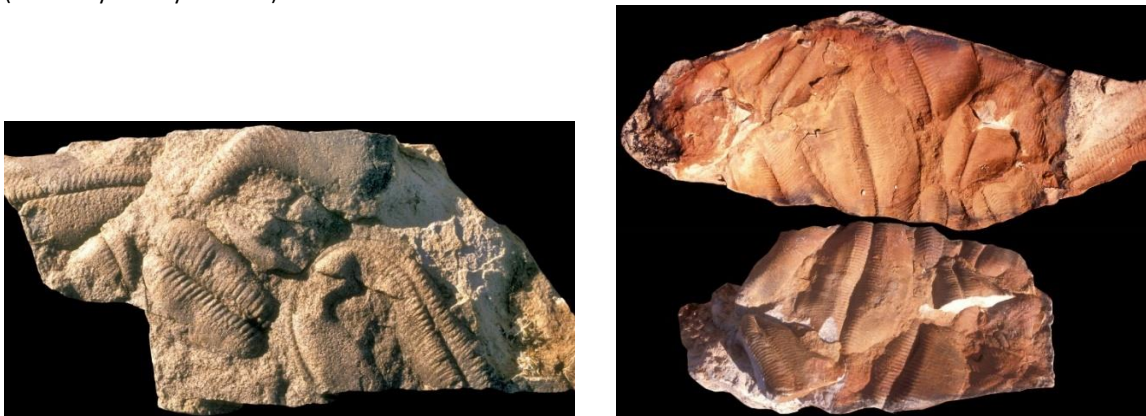
Left: *Ernietta* in the collections of the *Namibian Geological Survey* in Windhoek. Many different species names were given to this material, now sorted in these drawers according to those names. They all may be different preservational styles of the same species or just a few species. Middle: Complete *Ernietta* specimen that was one of many discovered and collected by the IGCP493, 587, 673 project team. Right: Most beautiful *Ernietta* material discovered by Andrey Ivantsov on Farm Aar. (Photo on left by P. Vickers-Rich; middle and right photos by Steve Morton). The collections in the *Namibian Geological Survey* in *Windhoek* house some 440 Ediacara specimens. Quite a number of these are historical collections that were made by Pflug and have thankfully not been destroyed in the Second World War, as so many other fossils from Namibia were in Germany.



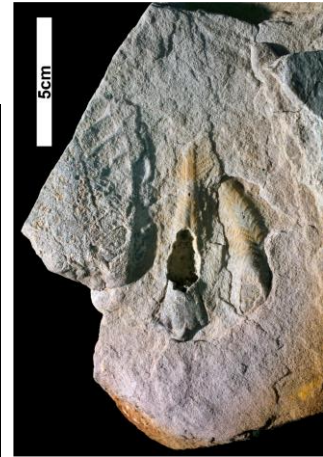
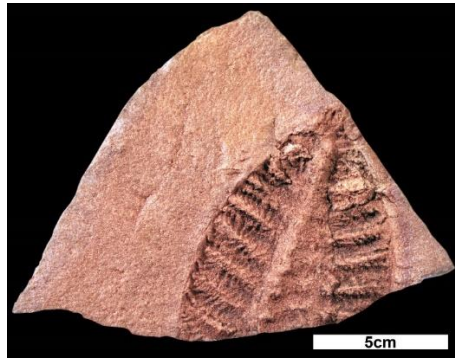
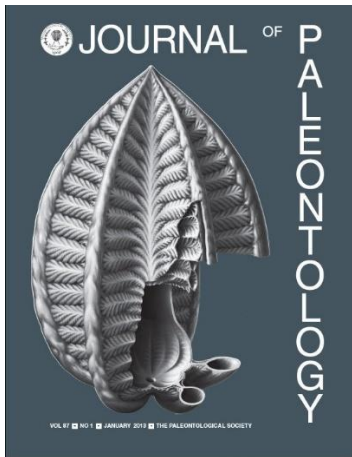
A major change in life occurred across the Precambrian – Cambrian boundary, now dated at 538.6 Mya in the latest Geological Time Scale publication (2020). Peter Trusler’s art showcases this change with the Precambrian on the left and the modern world we know on the right.



Left, *Beltanelliformis* (*Nemiana*) a form with many names and Right *Rangea* both found on Farm Aar, southern Namibia. (Photos by Andrey Ivantsov).



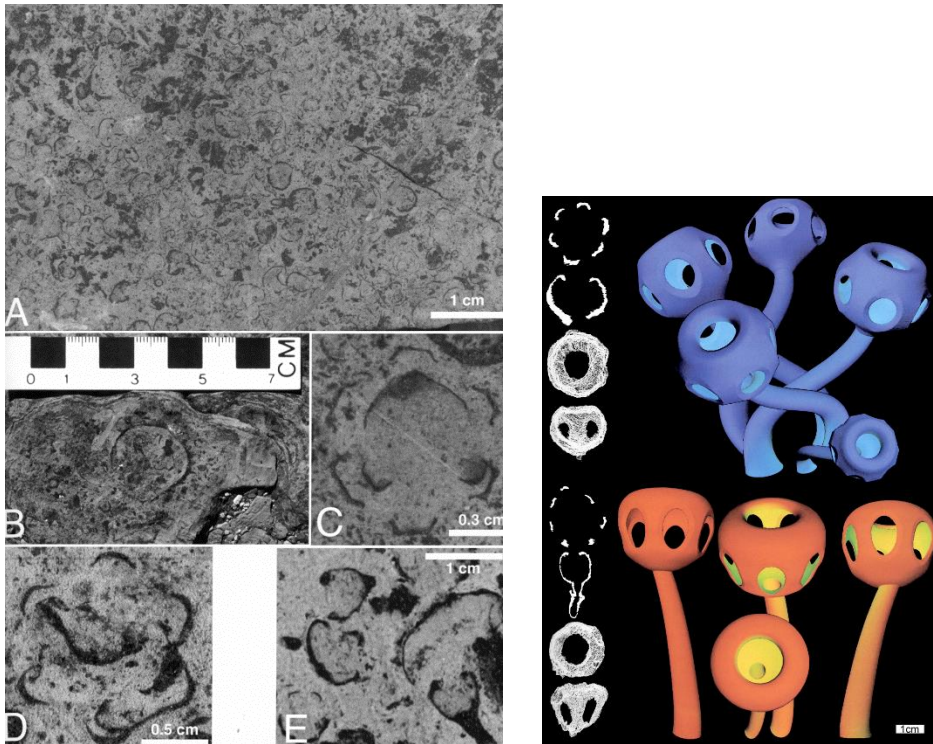
Pteridinium, both specimens discovered on Farm Aar. The specimen on the right had been long known by the landowners but most unfortunately had been stolen sometime in the last 10 years by “fossil looters,” a group which is becoming more and more worrying as new fossils are discovered and published by researchers. Both of these accumulations of fossils are part of downslope avalanches along the ancient marine shelves more than 540 million years ago. (Photos by P. Vickers-Rich)



Left. Publication on the new material that was discovered by the Fedonkin and Vickers-Rich team over years with the art of Peter Trusler displayed on the cover of the *Journal of Paleontology*. Middle. One of the few specimens of *Rangea* known before the exploration as part of UNESCO IGCP Project 493, found on Farm Kuibis. Right. *Rangea* cf. *schneiderhoehni*, Farm Aar, Aus region, Namibia, in 3-D! This is Pat's most treasured discovery in her life! It is one of the best-preserved fossils of this Ediacaran with its 3-D preservation. (Photos by S. Morton)



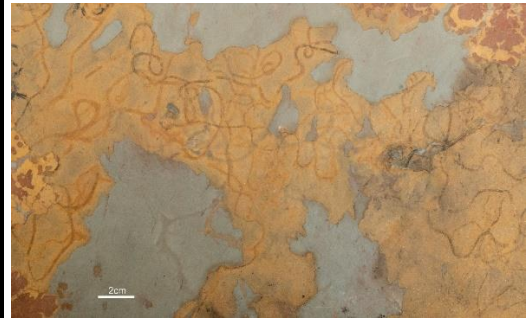
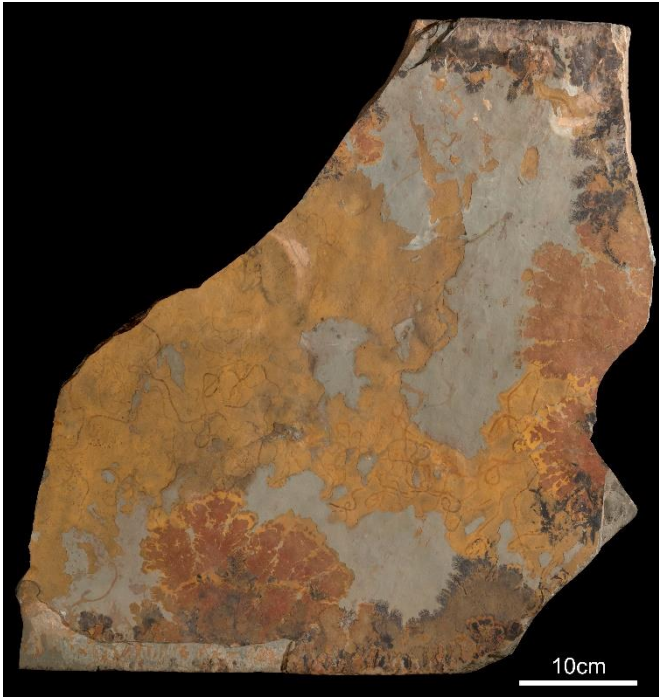
Left. *Asia fenestrata* from the Nama Group on Farm Plateau near Aus, which may be related to tunicates, oldest relatives. Right. One of the first organisms to form a hard skeleton, *Cloudina* from the Nama Group. (Photos by P. Vickers-Rich)



Left. *Namacalathus* from the Pinnacle Reef complex, Nama Group in southern Namibia. Right. Thin sections on left, with a reconstruction on the right. This form, like *Cloudina*, laid down a hard, external skeleton of carbonate. (From Grotzinger *et al.*, 2000).



Outcrop of Nama Group where *Swartpuntia*, a form related to *Pteridinium*, was discovered, southern Namibia at Swartpunt. This site is of particular importance as the sediments which were laid down here in a shallow sea record the passage of time from the Precambrian to the Cambrian and where the latest dating of this transition has been carried out. (Photos P. Vickers-Rich).



Traces left by moving organisms from near the Precambrian – Cambrian boundary in southern Namibia. The identity of the trace makers is yet to be determined. (Photos by Steve Morton)

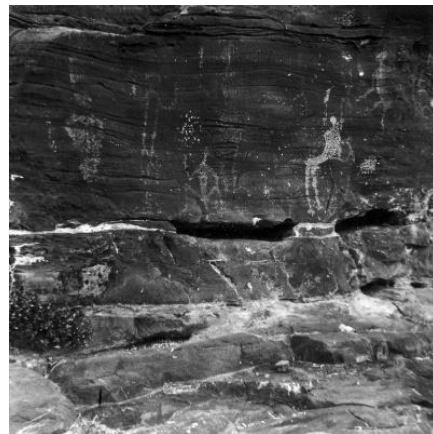
The Human History of Farm Aar

Farm Aar has so many treasures that it will hopefully one day be set aside as a World Heritage site. Besides the discoveries of the most ancient of its history, the Ediacaran, there is an abundance of traces and artifacts left behind by the San, the Nama and perhaps even older inhabitants of this region.

Rock carvings and paintings are frequent, not only on Aar but on many of the farms in the southern part of Namibia. These rare items are one of the reasons that this area of Namibia needs protection and recognition of its uniqueness by designation as a UNESCO World Heritage site.



A



B



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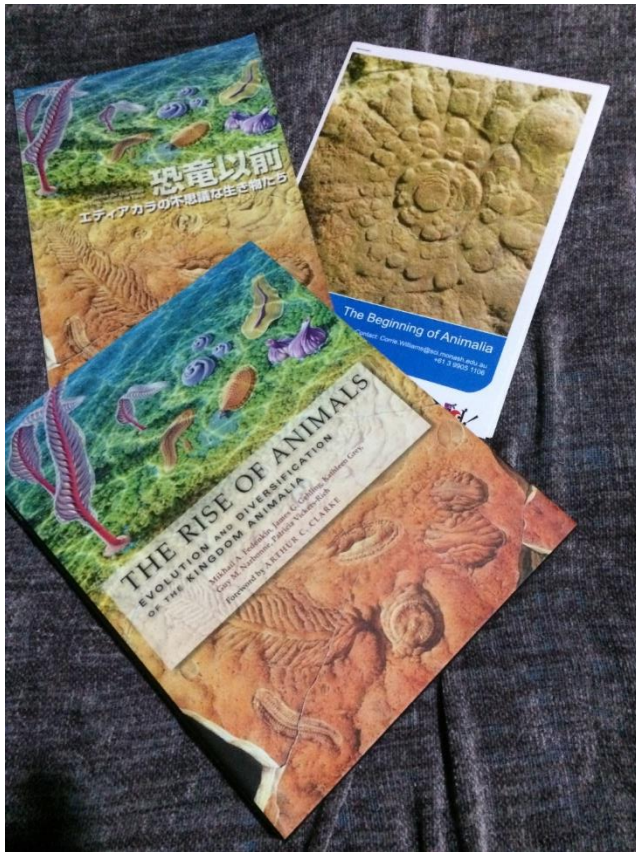


H

Just a few of the human treasures on Farm Aar that certainly need protection. A, Quartzite core at a tool-working site near Aarhauser; B, Human figure art near the homestead of Farm Aar; C-E, Overhang art near the homestead of Farm Aar and the overhang in which it was crafted, including the image of a whale tail; F, One of the many rock carvings found across Farm Aar; G-H, Snake painting found on the overhang surface of the Snake Cave on Farm Aar. (Photos by P. Vickers-Rich)



Rare though they are, these San rock carvings on Farm Aar suggest that the San people recognized the odd shapes of the Ediacarans in the rocks where they were preserved in this region. On the left a carving that resembles the morphology of *Pteridinium*, while that on the right was very likely inspired by the weird morphology of *Ernieetta*. The fossils of those two organisms occur in nearby rocks. Could this be the first recorded contact of humans and Ediacarans? (Photos by P. Vickers-Rich)



Some of the many books, exhibition catalogues and teaching kits that have resulted from the UNESCO projects IGCP493, 587 and 673 projects, treasures that have been made available globally. (Photos by Steve Pritchard)



The Ediacaran was a time when large, multicelled organisms invaded the global oceans. This cartoon by Peter Trusler captures that expansion of forms that had been previously been confined to specific environments with just the right salinity. As the seas became less saline, these forms moved in. This is a time in the late Precambrian when the fossil record explodes with biodiversity.

The Landscape of Southern Namibia Goes Beyond Just the Interest in Ediacarans

The interest that drew so many palaeontologists and many others to this part of the world for research is not just the fossils, but the draw of this stunningly beautiful landscape and its welcoming living inhabitants. From the isolation of so much of this land, to its modern fauna and flora, its long human history, *not to mention the Apple Cake at Helmeringhausen* – one cannot forget its impact and must forever want to return.



Two shirts that showcase entities that have been important to Pat's Namibian teams – the *Helmeringhausen Hotel* where the best apple cake (in the world – according to the ads!) can be found and *Savanna Car Hire* which had for years provided excellent rates and maintenance of the field vehicles used by Pat and her teams. (Photos by Steve Morton)



Team of science educators who visited Pat's Namibian field team (one being Pat on the right) after presenting at a conference in South Africa, highlighting the teaching potential of the results of the years of work on the IGCP Ediacaran fossil field work. Left to right: Lydia Low, Corrie Williams and Sandra Thong with Pat near Sossusvlei, where they held another small conference. (Photo by tour guide)

Namibia is a most extraordinary part of the world, and during the time since 2003 that IGCP493, 587 and now 673 have been active, it has been a place enjoyed for its many different landscapes. It has a long history from the time the first African humans left their carvings in the rocks on Aar and other places, and long before. Old train stations that stand abandoned were the watering points for the steam trains, and harbors like Luderitz served many purposes over centuries. The shipwrecks along the Skeleton Coast to the north and south of there bear witness to many tragedies.



Left. One of many old train stations where water tanks were kept active to serve the steam engines that use to ply these lands. Right. Luderitz, a harbour not far from the areas where the Ediacarans have been found preserved in the ancient marine sediments, now rocks. (Photos by P. Vickers-Rich)



Fauna and flora of southern Namibia in the Aus region: Left to right: Oryx herd, Meerkat, Social Weavers nests on Aar Farm. (Photos by P. Vickers-Rich)



Left. Ostrich in the Aus region. Middle and Right. Warthog and Giraffes north of Windhoek on the Game Reserve. (Photos by P. Vickers-Rich)

David Attenborough – His Final Life Documentary, *First Life*, Got Its Start in Namibia

No other communicator of science to the public in Pat's generation, continuing right up to now *communicating* to the current generation and in his 90's, has been more influential than David Attenborough. He is not only a star, but a truly down to Earth and approachable human truly interested in the future of humanity. Pat had began corresponding with David in 1987 when she sent him a copy of her and Gerry van Tets's book with artist Frank Knight – *Kadimakara. Extinct Vertebrates of Australia*. Attenborough had for a long time been a hero of Pat's, and his interest in the work that she and Tom were undertaking in the Cretaceous along the Victorian coast, especially at *Dinosaur Cove* was apparent. In one letter, he suggested that the next time he visited Australia "he would truly like to visit that site."

Correspondence between David and Pat continued over the years, and in 2007 she sent him *The Rise of Animals* that Fedonkin, Pat, along with Jim Gehling, Guy Narbonne and Kath Grey had pulled together showcasing the change in the biota from Ediacarans to true Animalia. He was fascinated. That eventually led to the doco he narrated, *First Life*. It was Pat's experience in Namibia at that original meeting in Cape Town that was the real beginning which eventually led her and her colleagues to write *The Rise of Animals* and send that book to David to try and entice him to begin (or end) such a documentary in Namibia – where life on Earth changed radically and forever over a very short time period.

The final random event that initiated the reality of the *First Life* doco on the beginning of Animalia began, again at a meeting, a conference in Norway - at the *International Geological Congress* in 2008 that both Pat and Mikhail Fedonkin attended in Oslo. There they came across one of the episodes of the *Life Documentary Series*. Pat suggested to some staff from *Atlantic Productions*, who were also attending this conference, that a perfect way to complete this series, could be to film the fossils of the truly first ones on the planet. The record of that time was to be found in Newfoundland, England, Australia, Russia and Namibia.

Pat began with a letter to David in December of 2008 suggesting that this would be a good idea. His reaction to this was quite expected:

Dear Pat. I would really like to make a documentary about all this exciting Pre-Cambrian work – and so get the BBC to pay for me to go to Newfoundland, Namibia, Siberia – and, of course, back to Ediacara. I will certainly float the idea here and there but I fear I may meet with some resistance. The programme would not be a cheap one to make because, quite apart from travel costs (if necessary I would forego Siberia!) the animations I would like to include are appallingly expensive. But we will see. David Attenborough, 31 December 2008

Pat and David continued pushing the idea.

Dear Pat. I am sorry to say that so far I have not had any success in persuading any of my contacts in the BBC to take up the idea of a programme about first animals..... I will, nonetheless, keep brooding on this idea – because I would so enjoy working on such a programme. As it happens, I am working with Atlantic productions on another palaeontological project at this very moment. So I hope you won't mind if the next time I am there and talking to them, I do a little gentle probing to see if we can get something together. David Attenborough, 9 April 2009

And that connection truly worked. Using the book that Fedonkin and Vickers-Rich and their colleagues had published in 2007 (*The Rise of Animals*) as a foot in the door with Anthony Geffen, who was the Head of *Atlantic Productions*, *First Life* began to develop and eventually the BBC was pulled into the fold.

Dear Pat. Thank you so much for your letter. I am indeed thrilled to be involved in this exiting project. Anthony Geffen is a marvellous organizer and invigorator. I've already seen some of his animations and to my eye at least, they seem very exciting. I hope you will think so too. As you know I got hugely excited by Ediacarans when I saw some of the fossils in the field, way back in 1978, and the thought of seeing some of the amazing discoveries that have been made since then is thrilling indeed. I can't wait to start on it & look forward hugely to working with you. With best wishes. David David Attenborough, 19 August 2009

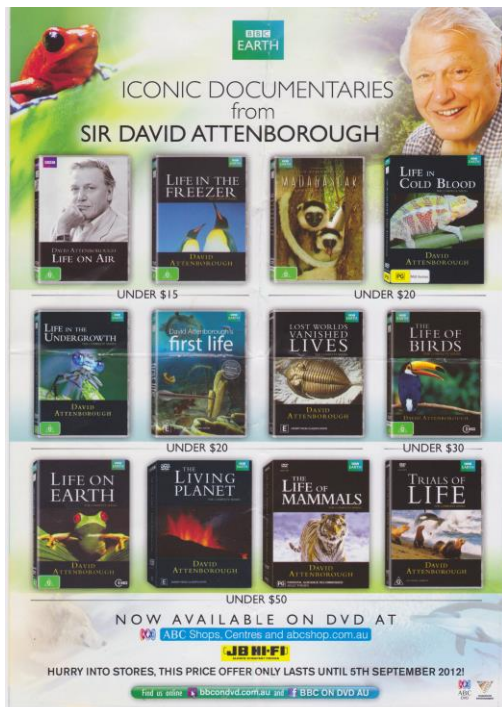
Pat had previously been in touch with Guy Narbonne, who had organized and directed much of the Precambrian work in Newfoundland, and Jim Gehling who was the head researcher on the Flinders Range material from which the name Ediacaran had originated from. She also contacted others that were part of the UNESCO IGCP project 493 about filming possibilities in Russia (Siberia and the White Sea – especially Mikhail Fedonkin), Namibia and Charnwood Forest in the UK. All were ready to move on this. The Charnwood, Newfoundland and South Australian filming went ahead, but try as she and David might, there was not enough funding available for the Namibia (nor for Siberia/White Sea). Pat had hoped that in the future those areas could be added to complete the story of this *First Life* (the Ediacarans, or Vendians as the Russians call these first, large, multicellular organisms). Fingers crossed!



Left. David Attenborough and Peter Trusler in the foreground discussing some of the Namibian material when David visited the Monash Science Centre in Melbourne during 2012. In the background from left to right are Michael Roberts (once an MSC staff member), David Elliott who finished his PhD working on *Pteridinium* and other material from Namibia, Ralph Sinclair (MSC staff) and Steve Morton (photographer extraordinaire). Right. Peter and David examining Pat's favourite *Rangea* from Namibia – a digital print of it made from a scan completed at the *Australian Synchrotron*! (Photos by Steve Moton)



David Attenborough with the three Emmys received for *First Life*! The push for the final episode of the *Life Series* that David had worked on for years came from a chance meeting of members of *Atlantic Productions*, directed by Anthony Geffen, Vickers-Rich and Fedonkin in Oslo (at the International Geosciences Congress). These awards were in the categories of 'Outstanding Nature Programming', 'Outstanding Individual in a Craft: Writing' and 'Outstanding Individual Achievement in a Craft: Graphic Design & Art Direction' in the News & Documentary Production. (Photo of David Attenborough provided by Anthony Geffen)



First Life was the final in this lifelong series pursued by Attenborough. The IGCP493, 587, 673 team were so pleased to see that something they had pursued come to fruition even when doco makers seemed only half interested to begin with. Determination in the end was successful to the delight of Attenborough and *Atlantic Productions* – and even the BBC!

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4 June 2021