

# Walking The Sacred Story

A New Ritual for Celebrating  
the Universe

Erna & Michael  
Colebrook

GreenSpirit  
Pamphlet No. 5



# **Walking the Sacred Story**

## GreenSpirit

GreenSpirit, the Association for Creation Spirituality in Britain, is part of a widespread movement exploring different ways of seeing, and living in, our world. More and more people are realising that we cannot continue using the earth and her creatures as if we owned them, increasing the gap between the haves and the have-nots in society, and despoiling the earth.

New insights from ecology, psychology and the physical sciences, linking the latest Western knowledge and understanding to traditional wisdom, can lead us to a different way of perceiving our presence on earth. We need a profound shift in thinking and feeling to convert the present over-consumption to a simpler, more compassionate way of living here.

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*The New Universe Story.* Michael Colebrook, 2003.

*What is Creation Spirituality?* Grace Blindell, 2003.

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*Imagining Otherwise.* Lindsay Clarke, 2004.

*How Things Come To Be.* Michael Colebrook, 2006.

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A New Ritual for Celebrating the  
Universe

By

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Kathleen Raine's poem *Ancestral Sun* appeared in Kathleen Raine. *Selected Poems* (Golgonooza Press, 1988) and is reproduced by permission of the publishers. The extract from the *Song of the Universe* by Patrick Huddie is reproduced by permission of the author.

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Listen to the air.  
You can hear it, feel it, smell it, taste it.  
Woniya wakan, the holy air,  
which renews all by its breath.  
Woniya wakan, spirit, life, breath, renewal,  
it means all that.  
We sit together, don't touch,  
but something is there,  
we feel it between us, as a presence.  
A good way to start thinking about nature,  
talk about it.  
Rather talk to it, talk to the rivers,  
to the lakes, to the winds,  
as to our relatives.  
*John Lane Deer*





# Introduction

*I only went out for a walk, and finally concluded to stay out  
till sundown, for going out, I found, was really going in.*

John Muir

This little book is about a walk and a story. The story is no ordinary story. It is the story of the universe from its beginning to the present. The best current estimate of the age of the universe is thirteen billion seven hundred million years (13,700,000,000) This is a span of time completely outside our experience as human beings. Simply relating the story in words does not even begin to create any impression of the immense periods of time involved in the formation of galaxies and the life and death of stars nor even of the evolutionary history of life on planet Earth. We believe that it is necessary to introduce some analogue of time as a complement to the story and we are suggesting here that a walk with distance representing the passage of time is a possible way of creating a much needed sense of perspective.

Over a hundred and fifty years ago the American essayist Ralph Waldo Emerson realised the significance of the then recent discoveries in geological time-scales. In an essay he wrote, '*We knew nothing rightly, for want of perspective.*'<sup>1</sup> Since then, studies in cosmology have led to assessments of the age of the universe as being ten times greater than the hundreds of millions of years assumed by Emerson. If we are to know things rightly we have to experience the story, not just listen to it.

## Putting the Walk in Context

The history of humanity has been marked by an ever increasing separation between people and nature. Our advanced technological age dominated by powerful multinational corporations has simply accelerated this process of alienation. The Earth in all its diversity of life forms and communities is being maimed and impoverished, often beyond the point of no return, to satisfy human consumerist cravings. We have to confess that humans have been the dominant species on Earth with an ever more domineering culture over all the other living communities, seriously endangering the support systems which brought us all into being in the first place.

Thomas Berry in his wonderful book *The Great Work*<sup>2</sup> is convinced that, '*The historical mission of our times is to reinvent the human – at the species level, with critical reflection, within the community of lifecosystems in a time-developed context, by means of story and shared dream experience*'..

There are many ways of cultivating our relationship with the Earth. One exercise that can help us to overcome our alienation from the rest of the natural world and help us reinvent ourselves is to take a cosmic time walk in which we symbolically retrace the Story of the Universe (the epic of evolution). It is the story of the universe from its mystical emergence about 14 billion years ago and its evolutionary unfolding and expansion to the present day. A very long story indeed. A truly sacred story.

When we ground our higher awareness in an ecological and cosmological context a number of things happen to us. Firstly, we rediscover a sense of awe and wonder for the time and space dimensions of the universe.

Secondly, we rediscover a sense of oneness with all creation through the process of evolutionary remembering. Rediscovering our ecological selfhood redirects our consciousness and liberates our psychic energies. The strength and wisdom of the living Earth in all its manifestations flows through us again. This enables us to make choices to help liberate nature and restore the equilibrium of our home, planet Earth. By liberating nature we liberate ourselves and recover our sense of belonging.

Thirdly, we realise that we are the means by which the universe has become conscious of itself.

All this engenders feelings of reverence, humility, gratitude, delight and love. We understand that we are here to celebrate this wonderful, amazing, incomprehensible, glorious, exciting and dangerous universe and to acknowledge the mystery that pervades it.

We rediscover a sense of meaning.

### **The Need for Creation Stories**

Every culture has its own enchanting creation story, explaining the relationship between the human, nature and the divine. Psychologists tell us that humans are soul people who need to know with every fibre of their being who they are in their relationships and give assent to it. We crave to know our larger place in the scheme of things and where we came from for, *'if you don't know the past, then you shall not have a future. If you don't know where your people have been, then you won't know where your people are going'*<sup>3</sup>. This is the message given to Little Tree, a young Cherokee Indian boy. It is also good advice for new millennium people and which is why cosmic time walks are important and have a vital role to play in our human survival on this planet. Before we build fancy futures we need to reconnect with our roots. Our historical roots, of course, but also with our biological and deepest cosmic roots. We need to know who we humans really are. We need to know what our fundamental relationship is with the rest of creation.

Our creation story gives us what we call a world view with which we should be able to construct a balanced human culture in harmony with the rest of the natural world. That is of course if we adopt pertinent lifestyles to underpin it.

### **The Creation Story of Western Culture**

For the last two millennia, our Western culture's creation story has been the story as told in the book of Genesis in the Bible, where God's spirit created the world and everything in it in six days: light and darkness, heaven and Earth, sun and moon, all manner of plants, birds, sea monsters, every kind of creature moving in the water, cattle, reptiles, wild animals, and last of all, He made man and woman in His own image. God

surveyed each day and saw ‘that it was good’. Before He took a rest on the seventh day, God found it all ‘very good’.

God gave the first man and woman his blessing and said, ‘*Be fruitful and increase, fill the Earth and subdue it and rule over the fish of the sea, the birds of the air and every living thing that moves upon the Earth.*’<sup>4</sup>

There is a second story in Genesis where Adam and Eve, the first human couple living in the perfect Garden of Eden, rebel and reach for their freedom when picking the apple. The universe, it would seem, is created by God as a universe of choices and possibilities.

### **A Creation Story from the Ancient Greeks**

Other cultures have their own creation stories. Old-World creation stories often involve a snake or a dragon. One of the oldest stories is from the ancient Greeks<sup>5</sup>.

*In the beginning, Eurynome, the Goddess of All Things, rose naked from Chaos, but found nothing substantial for her feet to rest upon, and therefore divided the sea from the sky, dancing lonely upon its waves. She danced towards the south, and the wind set in motion behind her seemed something new and apart with which to begin a work of creation. Wheeling about, she caught hold of this north wind, rubbed it between her hands, and behold! the great serpent Ophion. Eurynome danced to warm herself, wildly and more wildly, until Ophion, grown lustful, coiled about those divine limbs and was moved to couple with her. So Eurynome was got with child. Next, she assumed the form of a dove, brooding on the waves and, in due process of time, laid the Universal Egg. At her bidding, Ophion coiled seven times about this egg, until it hatched and split in two. Out tumbled all things that exist, her children: sun, moon, planets, stars, the Earth with its mountains and rivers, its trees, herbs, and living creatures. Eurynome and Ophion made their home upon Mount Olympus, where he vexed her by claiming to be the author of the Universe. Forthwith she bruised his head with her heel, kicked out his teeth, and banished him to the dark caves below the Earth.*

### **Indigenous Creation Stories**

Indigenous people from all round the world – and there are some 200 million of them – have creation stories by which they have lived successfully and to which our Western civilisation is now turning for inspi-

ration. Creation stories from the New-World and the Pacific often involve a turtle. An example is the story of the Maidu Indians of California<sup>6</sup>.

*In the beginning there was no sun, no moon, no stars. All was dark, and everywhere there was only water. A raft came floating on the water. In it were two persons, Turtle (A'noshma) and Father-of-the-Secret-Society (Peheipe). The stream flowed very rapidly. Then from the sky a rope of feathers, called Pokelma, was let down, and down it came Earth-Initiate. When he reached the end of the rope, he tied it to the bow of the raft, and stepped in. His face was covered and was never seen, but his body shone like the sun. Turtle said, 'Where do you come from?' and Earth-Initiate answered, 'I come from above.' Then Turtle said, 'Brother, can you not make for me some good dry land, so that I may sometimes come up out of the water?' You want to have some dry land: well, how am I going to get any earth to make it of?' Turtle answered, 'If you will tie a rock about my left arm, I'll dive for some.' Earth-Initiate did as Turtle asked.*

*Turtle was gone a long time. He was gone six years; and when he came up, the only earth he had was a very little under his nails; the rest had all washed away. Earth-Initiate took a stone knife and carefully scraped the earth out from under Turtle's nails. He put the earth in the palm of his hand; and rolled it about till it was round; it was as large as a small pebble. He laid it on the stern of the raft. By and by he went to look at it; it had not grown at all. The third time he went to look at it, it had grown so that it could be spanned by the arms. The fourth time he looked, it was as big as the world, the raft was aground, and all around were mountains as far as he could see. The raft came ashore at Tadoika and the place can be seen today.*



## **A New Creation Story for all Humanity: the New Universe Story**

Thousands of years on we can set a new creation story alongside the many older ones. This story tells us that the universe is about 13.7 billion years old, and that over those many millennia everything came into being through a sequence of evolutionary transformations from the minute fireball. Through these transformation episodes, the universe has passed from a lesser to a greater complexity in structure and from a lesser to a greater mode of consciousness. It is both a physical and psychic universe whose emergence continues from day to day. It is the story of the unfinished journey of everything in the universe, including of course, the unfinished journey of planet Earth with all its life forms. It is in the context of an emergent universe that humans will find their true place and fulfilment. We call this cosmology the New Universe Story.

Here on Earth the main players have established themselves over aeons into the great Earth cycles: the cycle of water, the cycle of rock, the atmospheric cycles of oxygen, carbon dioxide and nitrogen and the cycle of life, death and rebirth. These cycles are driven by energy from the sun, act upon each other and are dependent upon each other.

Scientists world-wide have uncovered this story bit by bit. And now it can be pieced together into an organic whole, into a story which is so much greater and nobler than its constituent parts. It is the story of an evolving, interdependent universe becoming conscious of itself after 13.7 billion years; we its humans stand in awe and wonder, lost for words, sensing the ultimate mystery pervading all. We must claim it as our creation story. There are some excellent books for the lay person to read (see Bibliography). The importance of the new creation story lies in the fact that it is everyone's story. We all originated in that primordial fireball 13.7 billion years ago. All life forms are genetically related to each other. Every existing human culture could adopt the scientific creation story alongside its traditional story. The scientific story binds us all together as sisters and brothers who have come to realise how vulnerable all life has become.

Ursula Goodenough<sup>7</sup>, a cell biologist, sums it up well, '*Humans need stories - grand, compelling stories - that help to orient us in our lives and in the cosmos. The Epic of Evolution is such a story, beautifully suited to anchor our*

*search for planetary consensus, telling us of our nature, our place, our context. Moreover, responses to this story - what we are calling religious naturalism - can yield deep and abiding spiritual experiences.'*

The natural world is so extraordinarily beautiful and awe-inspiring and its history of evolution over 13.7 billion years so humbling that to learn about it, not only through the medium of books, pictures, TV or film, but to experience it, bodily at the core of our being, walking, is an experience which could be called mystical. There develops a feeling of intimacy, of relatedness and of kinship with all creation. As our deeper sensibilities are being nourished we discover the metaphysical dimensions of the scientific story.

### **Sacred Time Walks**

People have been fascinated by labyrinths for more than 3000 years. It is the idea of a path representing the passage of time; it is the thread of time, the path of life, turning and coiling and finally arriving at the centre of perfection. In the Middle Ages labyrinths began to appear on church floors and were called pavement labyrinths. The most famous is in Chartres cathedral and is 13m across on the floor of the nave. People can still be seen walking this labyrinth in silence on Good Friday. What are they seeking? Answers to questions such as what is the meaning of life? Where do I find light, truth, inner peace? Seeking perhaps a closer union with God. It is a personal spiritual quest. Walking the labyrinth means taking risks to arrive, after much outer and inner work, at its centre.

Just as people have found walking the labyrinth beneficial and satisfying soul-work, so is the cosmic time walk more than just a walk. The original concept of the walk comes from the U.S., from Sister Miriam Therese MacGillis of Genesis Farm, New Jersey. We ourselves have taken part in a number of these walks here in Britain. Participants are amazed at how it affects them at different levels of their being while the Epic of Evolution (the Universe Story) is unfolded to them while walking the Earth.

The cosmic time walk can be undertaken anywhere. Where there is some semblance of wilderness is preferable, but large gardens, parks, along a river bank, in a wood, or moorland are all equally suitable places.

Usually the layout of the path will be constrained by the locality but where a large open space is available it might be worth considering a spiral walk. In the following pages we provide the outlines of two versions of the time walk. Firstly, (pp. 16-37) we suggest some possibilities for conducting a walk, based on a linear or circular route of 1.37 kilometres. As the age of the universe is 13.7 billion years, each metre represents ten million years. At a slow walk this means that each step is five million years. The second walk (pp. 38-53) is much shorter, just 200 metres. On this walk the time represented by each step varies along the length of the walk in order to accommodate the time-scale of significant events as the story progresses. We have also assumed that the walks will be done by groups led by a narrator who tells the story at a sequence of stopping points along the path. This basic plan can, however, be adapted to suit other circumstances such as a permanent layout with the elapsed time marked by fixed points. The long walk can be scaled to accommodate shorter distances than the full 1.37Km but there is a practical limit at about 500m as the stages become very crowded (see p.59).

A walk in the form of a spiral seems to be a very appropriate layout if this is at all practical. The spiral is such a potent symbol with which to represent the 13.7 billion year evolutionary unfolding of the universe that we should not overlook its significance. The spiral combines the cyclical with the expansive. In this it reflects the creative and evolutionary processes of the universe. At its heart everything tends to the cyclical but emerging from these cycles is change and growth. The Earth evokes the power of the cycle, evolution the arrow of time. The synthesis of the two gives us the spiral. The open-endedness of the spiral points to potential and freedom. Its form points to rigidity, structure, laws and responsibilities. Spirals are found in nature, in the shells of gastropod molluscs and in the living ammonite *Nautilus*. We see them also in the unfolding fronds of ferns. The spiral is a symbol which was used and valued in ancient times. Marija Gimbutas<sup>8</sup> writes, *'the snake and its abstracted derivative, the spiral, are the dominant motifs of the art of Old Europe [6500-4500 BCE], and their imaginative use in spiraliform design throughout the Neolithic and Chalcolithic periods remained unsurpassed by any subsequent decorative style until the Minoan civilization'*.

Sacred spiral walks have not yet been constructed (as far as we know) in Great Britain, though we have an account of such a construc-

tion on a piece of land in South West Australia. It can only be a matter of time and funding before sacred spirals are built here. If the labyrinth guides the walker to its centre, the sacred spiral walk demands a start from the centre outwards.

## **A Ritual for the Third Millennium**

*'At all times and cultures, human beings have used ritual to help us remember who we are. Through ritual we re-enact our place in the cosmos. It is the human vehicle for encounters with the numinous. It offers a tried and tested containment for that meeting, a means to lose ourselves and yet return safely to the everyday world afterwards',* writes Alex Wildwood<sup>9</sup>. It is a good definition of ritual.

The cosmic time walk has the potential to become a beautiful ritual for everyone on the planet, not only binding all humanity and all life on Earth, but the whole universe into a glorious celebration. Reminding us of our common roots and affirming us in the present. Energising us, liberating us, and offering new life. It is a powerful context for identifying and addressing fundamental issues of the future, whether social, personal, governmental or spiritual.

## **Changing Perceptions**

When we have completed the cosmic time walk we may at some point want to evaluate the impressions we have received from so many sources during the walk.

What is the relationship between nature, the human and the divine in the New Universe Story? We have discovered that we are related to everything that exists in the universe, that its deeper rhythms are reflected in us, that we are truly Earthlings, icons of the universe. We have been knitted into the web of life and while we are only a strand in it, we humans are the universe become conscious. A tremendous privilege but also a responsibility. We discover that we have a glorious ecological self. The perception of our relationship with nature is no longer one of alienation but of intimacy. We recover a sense of belonging.

Our perception of where the divine is, is also changing. The idea that the divine is either remotely 'out there' or 'among us' in our relationships does not seem to fit the new reality we find ourselves in. We

respond more readily and are nourished by the perception of a Numinous Source whence all things in the universe come into being. We prefer to see God in everything and everything grounded in God. We are rediscovering the presence of the sacred in all creation.

The cosmic time walk may bring us to a new awareness that we are spiritual beings, soul people, who are nourished and healed by our intimacy with nature. Our new found spirituality is firmly Earth-directed as we start to explore day by day more sustainable co-operative lifestyles. What is demanded from us, considering our domineering and wasteful consumerist addictions is how to develop a mutually enhancing life-style with the rest of the natural world, a compassion which is not limited to our fellow human beings. To reach our full humanity our love and care must extend to the whole of Earth.

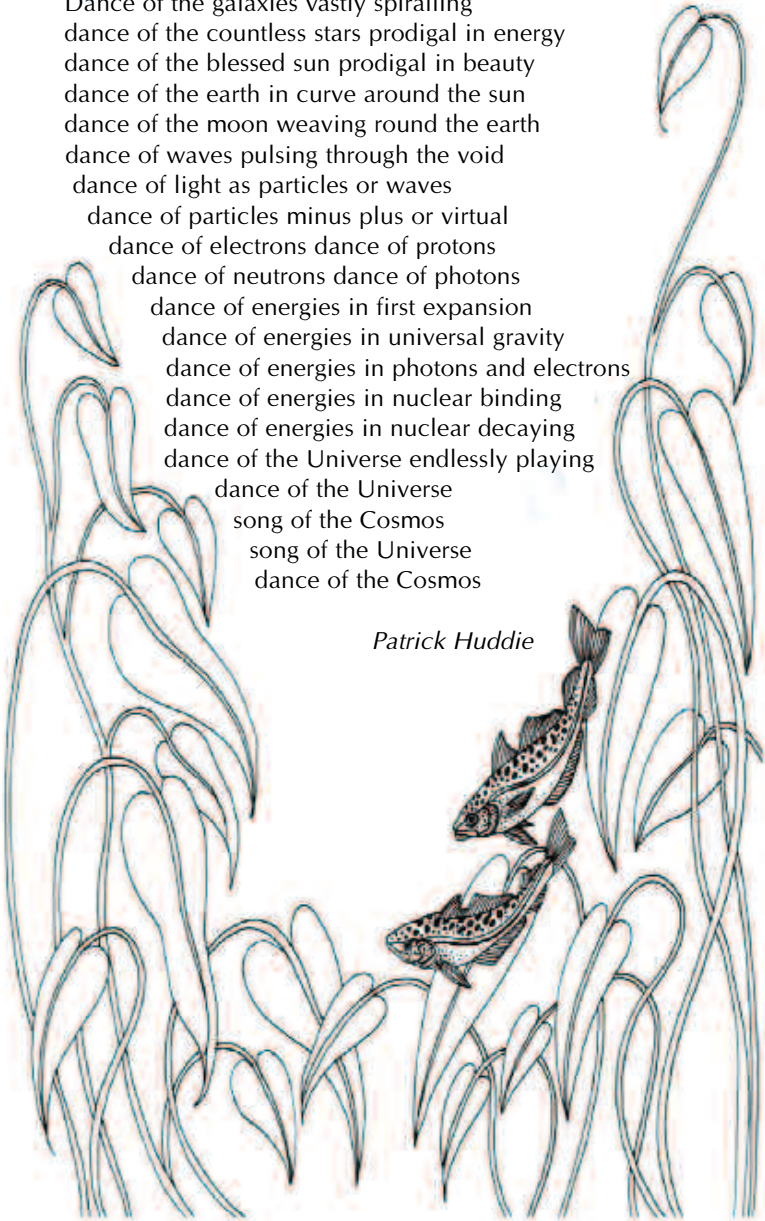
We may realise that the cosmic time walk is not only a new ritual to celebrate the universe but it is also a tool for bringing about a change in our human consciousness, for aiding the integration of our inner and outer world, and that it has the potential for bringing about a human re-alignment with the universal order of things.

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Song of the Universe is Cosmic Dance  
Dance of the galaxies vastly spiralling  
dance of the countless stars prodigal in energy  
dance of the blessed sun prodigal in beauty  
dance of the earth in curve around the sun  
dance of the moon weaving round the earth  
dance of waves pulsing through the void  
dance of light as particles or waves  
dance of particles minus plus or virtual  
dance of electrons dance of protons  
dance of neutrons dance of photons  
dance of energies in first expansion  
dance of energies in universal gravity  
dance of energies in photons and electrons  
dance of energies in nuclear binding  
dance of energies in nuclear decaying  
dance of the Universe endlessly playing  
dance of the Universe  
song of the Cosmos  
song of the Universe  
dance of the Cosmos

*Patrick Huddie*



# Practicalities

## Notes for the Walker

The long walk is 1.37 kilometres (a bit less than a mile) long and will take one and a half to two hours to complete. As the universe is 1.37 billion years old, each meter equals 10 million years and each step you are about to take is 5 million years. Just let that fact sink in for a moment! If this seems too far to walk you can easily make each step 10 million years and halve the number of steps given in the description of the walk. If this is still too long there is the short walk of just 200m. You may be walking on your own, or more likely, be part of a small group of people doing the walk with you. You may be accompanied by a narrator who will tell the story of the universe at each stopping point. The actual walking should be done, if possible, in silence and with awareness. At each stage, having learnt about the next stage of the evolution of the universe, you may want to respond with a poem, song, music (a drum perhaps). You may have ideas of your own. Or you may want to remain silent. Travelling through time and space you will be caught up in a stupendous journey, an interactive adventure which will engage your whole being at different levels: your physical body and its senses, your reasoning mind, your imagination, your emotions, your deepest longings and your search for ultimate values. So open yourself up and let all creation dance for joy within you. For not only are you following step by step our own human journey, it is also the journey of every atom, every galaxy, every star and every creature from the beginning of time. It is your own journey from the beginning of time.

While the cosmic time walk is a journey on the ground, it is also a tremendous journey of the imagination. The whole interactive experience may help you to re-define who you are and to reevaluate your priorities on planet Earth.

## Notes for the Narrator

A thorough preparation is essential before you take a group on a Cosmic Time Walk. Familiarise yourself with the contents of this book. If you are not too familiar with the New Universe Story you should do some further reading. There are some excellent books listed in the bibliography.

The Universe Story is not only a scientific story, it is a sacred story. It is therefore appropriate for you to prepare yourself in prayer – that is if you are the praying kind – or in meditation. The work you are about to undertake is of a priestly kind, as the interpreter of ‘the Book of Nature’. Choose your walk with care. Almost anywhere on Earth is suitable: from a wilderness to a park or large garden. Keep the size of your group small, not more than 12–15 people, so that everybody can easily hear the story. The long walk is 1.37 Km with each pace equivalent to 5 million years. But as has already been mentioned the walk can be scaled for other distances (see p.58). Step out the walk you have chosen and mark or memorise at least some landmarks on the route. This is less critical for the short walk but for both walks it is easy to lose count of steps while leading the walk. It is useful to have some markers where you can make corrections. An alternative is to have a colleague who counts the steps for you.

Read up something about the local geology so that you can set the walk in the context of Earth history. A sense of place and time enhances a sense of belonging. Before you set out with your group explain carefully what you will be doing. Explain how each step represents the passage of time in the unfolding of the story of the universe. The long walk has been divided into 31 stages of varying length and the short walk has 15 stages. The heading of each stage gives the number of steps to be taken in the next stage, the total number of steps, and the age of the universe in millions of years. Between each stage the group will stop and you will tell the relevant bit of the story that is about to unfold, inviting the walkers to ponder the story while walking. The account given is factual and may contain more detail than you think is necessary. It is up to the narrator to present it to the group in whatever way he or she is inspired.

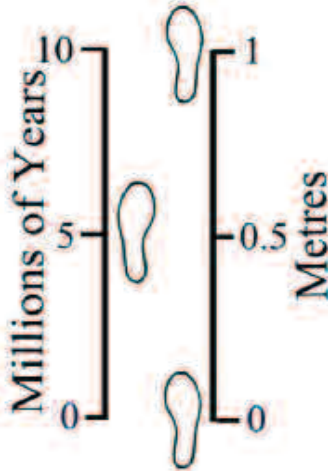
If appropriate, allow time at stops for comments, questions, poetry, readings, chanting, drumming or other activity such as hugging trees, touching the earth or saluting the sun. Some sources of possible material are included in the bibliography. The walk will take one and a half to two hours. See that your group is suitably prepared, clothed, shod etc. in order to fully enjoy the experience.

At the end you could form a circle and hold hands, singing an appropriate song or chant, You could also perform the Hindu Namaste greeting: palms together raised to the forehead, with a bow. This symbolises 'the divinity within me salutes the divinity within you'. So make Namaste to the group, to each other, and then finally turn to face outward and make Namaste in honour and gratitude to the whole Cosmos, the whole of Creation.

Some kind of shared meal at the end – a picnic or a barbecue – is a nice way to conclude the walk.

# The Long Walk

1.37Km



Distance	Years
1m	10,000,000
0.5m	5,000,000
10cm	1,000,000
1cm	100,000
1mm	10,000

It is important to make sure that participants have a clear idea of the time scale of the walk. It might be an idea to give each participant a grass stem or twig just 10cm long and representing 1 million years. The thickness of one of the pages of this book represents about a thousand years.

## Walking the Sacred Story

In the Beginning – nearly 14 thousand million years ago - was the Big Bang, only it wasn't. It certainly wasn't big in terms of size because there was no space in which size could exist. It certainly wasn't a bang because there was no time in which a bang could happen. It may be useful to think about something we can call the 'Stuff of the Universe' and about which we know very little. All that we can say is that it can be thought of as both the unifying principle of the universe and as the potential for everything that is now, ever has been and ever will be.

It is tempting to visualise the birth of the universe from the outside as a minutely small, incredibly hot sphere of something, appearing in space and expanding in all directions at the speed of light. But this is a false image because the universe does not have an outside. In trying to describe the creation event, both language and imagination fail us. The best we can do is to say that the 'Stuff of the Universe' **became**. There was only a sort of shiver, a whisper, a sigh; perhaps in our poetic imagination we could call it the soft voice of God saying "*Behold*". This soft voice has been echoing down the aeons of time, at every twist and turn of the evolutionary journey of the universe. In its becoming, the 'Stuff of the Universe' probably displays perfect symmetry, it is without attributes of any kind. We cannot visualise, we can only imagine, but it seems that the Stuff of the Universe imposes constraints on its own perfect symmetry. Space emerges, so that it can expand. Time emerges so that it can evolve. Forces emerge, which we recognise today as gravity, electro-magnetic force and the nuclear forces, so that space can have structure and evolution can be creative. In terms of the newly emergent dimension of time all this happens in a minute fraction of a second. At this stage we can think about the Stuff of the Universe in the form of very, very, very hot energy. As the expansion continues the universe cools down enough for matter to emerge through the spontaneous appearance of particle and antiparticle pairs. At first these destroy each other as fast as they appear. After another small fraction of a second a minute asymmetry emerges and for every 3 billion annihilations one particle of matter survives. By the time the universe is one second old, all the antimatter is destroyed

and the tiny proportion of matter that is left is in the form of the particles that are the building blocks of atoms and molecules. This, nevertheless, forms all the galaxies and stars that now exist!

After about 300,000 years, just 3 cm of our journey, the universe becomes cool enough for positively charged protons and negatively charged electrons to begin to pair up more or less permanently. The first atoms of hydrogen and helium emerge. This also has the effect of making the universe transparent. We can now begin to visualise, in our mind's eye, the rest of this magnificent story. The stage is set. We can now start our walk — our journey through time.

### **Stage 1 - 100 Steps (total 100) to 500 million years**

The universe takes the first steps towards the emergence of structured entities on a macroscopic scale. The force of gravity is linked to the presence of energy and the mass associated with it according to relativity theory. Minute ripples in this mass produce variations in the gravitational field. This attracts matter towards the areas of higher density, thus increasing their gravitational fields. The hydrogen and helium begin to take on shape and form.

A strange legacy of the enormous destruction of matter in the first second in the life of the universe was the production of vast numbers of particles called neutrinos, one for each particle/anti-particle interaction. Neutrinos do not interact with anything, they just buzz around the universe being neutrinos. Even today, there are about 100 million of these neutrinos in every cubic metre in the universe, passing through each of us in large numbers and at high speeds as if our bodies were not there. In the relatively small early universe their density is much greater and this contributes significantly to the gravitational field. Their presence helps to give shape to vast clouds of hydrogen and helium, giving birth to the first galaxies within the first 500 million years. Galaxies are not uniformly spread throughout the universe but are structured into flattened clusters and groups within clusters. In this first stage of our time journey let us celebrate the neutrino and its role in forming the early galaxies.

### **Stage 2 - 100 Steps (total 200) 500 to 1,000 million years**

The next stage sees the continuing emergence of galaxies and stars. The most stable form for a cloud of gas with its gravitational field is a more or less circular or elliptical disk and most galaxies take these forms.

Within these young galaxies there are also clumps of denser gas and their gravitational fields sweep in surrounding matter. When these form coherent masses they develop structure in the form of an increasing density gradient towards the centre. With increasing density comes increasing temperature and increasing pressure which opposes the compressive gravitational force. A clear structural entity emerges and a **star** is born. The density and temperature at the heart of the star continues to rise until it gets hot enough for hydrogen atoms to fuse together to form helium. The temperature is about ten million degrees. This reaction produces more heat, increasing the pressure within the star. A balance is achieved between gravity compressing the matter of the star and the pressure in the star due to the heat generated by nuclear fusion. In our own star, the sun, about four and a half million tonnes of hydrogen are fused into helium every second. Clearly this cannot go on for ever. Stars have limited lives; sooner or later gravity begins to win. For stars about the size of the sun, and up to ten times larger, the remaining hydrogen is blown off into space and all that remains is an incredibly dense core about the size of the Earth. It becomes what astronomers call a white dwarf. For many stars the life from birth to effective death is about 500 million years.

On this stage we will walk the life of one such star. Think about its birth, its life in dynamic equilibrium involving the alchemist's dream of the transmutation of elements, and finally its transformation into an incredibly dense but inert mass of matter.

*If possible, at the end of this stage ask the participants to look back to the start of the walk and realise that they have just walked a billion years. About one fourteenth of the history of the universe.*

### **Stage 3 - 400 Steps (total 600) 1,000 to 3,000 million years**

The processes within the major galactic clusters continue. New galaxies form. Within these, new stars are born and die. The matter from dying stars is recycled into new ones. Behind all these processes and through the aeons of time is gravity. Gravity also plays a key role in the form of almost every macroscopic structure in the universe, from galaxies to rain drops. It is why trees grow up and roots grow down. Its influence is felt across the vast distances of galactic clusters as well as by apples hanging from trees. And yet it is one of the deepest mysteries of the universe. On this stage of our walk be aware of your own weight as we are drawn towards the centre of the Earth. Think also about gravity on the cosmic scale. Thomas Berry describes gravity as the great compassionate curve within which the universe is enfolded.

### **Stage 4 - 1190 Steps (total 1730) 3,000 to 8,950 million years**

It is probable that at some time during the next few billion years our own galaxy, the Milky Way, is born. The Milky Way is just one of about a thousand galaxies forming what is known as the Virgo cluster, and within this cluster, the Milky Way is on the edge of a small disk shaped group of some two dozen galaxies. The Virgo cluster is some two billion light-years across and our local group is moving towards the centre of the cluster at a speed of about 600 kilometres a second, roughly a million miles an hour.

Altogether there are about a hundred thousand million galaxies in the observable universe, and the Milky Way contains about a hundred thousand million stars.

On this long stage of the journey you are invited to think about these enormous numbers and the vast expanses of space and time. During this stage we will be walking the equivalent of nearly 6000 million years, nearly half the age of the universe. Think of all this as an essential preparation for what is to come. Following this stage we will progressively narrow our focus, to our own galaxy, then to our own star, the sun, and then to our own planet the Earth.

### **Stage 5 - 50 Steps (total 1780) 8,950 to 9,200 million years**

We now have completed nearly two thirds of our journey. The Milky Way galaxy has the form of a flattish disk with spiral arms consisting mostly of interstellar gas. It is about a hundred thousand light-years in diameter. In addition to hurtling through space towards the centre of the Virgo cluster of galaxies, the Milky Way also rotates around its centre and each rotation takes 250 million years. As the spiral arms swing around the centre of the galaxy they produce waves in the gravitational field. This produces favourable conditions for the formation of new stars. In this way new stars are constantly being born while others are dying. Many of the larger stars do not live long enough to complete an entire circuit.

The next stage of our walk is the equivalent to one complete rotation of the galaxy around its centre. Think about the galaxy as a dynamic entity in which stars are born and live and die.

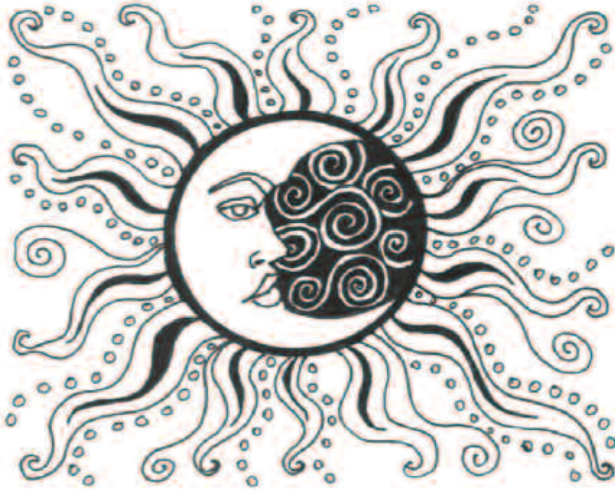
### **Stage 6 - 30 Steps (total 1810) 9,200 to 9,350 million years**

During this stage we will consider the story of one star that lives its brief life at about this time in the history of our galaxy. At its birth it is much larger than our sun and the death of such stars is dramatic. Brian Swimme and Thomas Berry have suggested that this particular star should be called Tiamat after the Babylonian Goddess from whose dead body the sky and the Earth were formed. It was during the death of this star that were forged most of the chemical elements that form the Earth. The following passage is edited from Swimme and Berry's book.

‘In the unbearable pressures and enormous temperatures near the centre of a large star, hydrogen is burned into helium, helium is burned into carbon, carbon is burned into oxygen. Anything available as fuel is shovelled into the nuclear furnace to stave off gravitational implosion. But after millions of years of striving in this way, Tiamat found herself pressed to the wall, exhausted by the effort, helpless to do anything more to bal-

ance the titanic power of gravity. When her core had been transformed into iron, she sighed for the last time as collapse became inevitable. In a cosmological twinkling, her gravitational potential energy was transformed into a searing explosion, a single week-long flash of brilliance that would catch the attention of every watchful creature in the galaxy. But when the brilliance was over, when Tiamat's journey was finished, the deeper meaning of her existence was beginning to show through. Out of the spectacular tensions in the stellar core, Tiamat had forged tungsten, copper and vanadium. She vanished as a star in her grand finale of beauty, but the essence of her creativity went forth in wave after wave of fluorine, astatine and bromine. Tossed into the night sky were caesium, rhodium and titanium. None of these elements had appeared in the primeval fireball or in the early galactic era. These beings were new, and though mixed inconspicuously into the dark clouds that wafted out from Tiamat's explosion, in their essences, in their potential power, they glittered as brilliantly as the super-nova incandescence. Tiamat had forged calcium, a new presence that would one day support both mastodons and humming birds. Tiamat had forged phosphorus, which would one day enable the majestic intelligence of photosynthesis to appear. Tiamat had sculptured oxygen and sulphur, which one day would somersault with joy over the beauty of the Earth. Great destruction, unbearable violence, and out of this Tiamat invented the cosmic novelties of carbon and nitrogen, two astounding powers that would one day sparkle as life. Tiamat's story – the story of her brilliance, her creativity, her passion, her destruction – is a sacred intensification of the universe's journey. In her story we witness a burst of glory, an amplification of the universe's beauty, and a dangerous and joyful release of power'.

Within a time span of 150 million years Tiamat is born, flourishes and dies, leaving a cloud of gas and dust some of which will soon be recycled and involved in the birth of our solar system. This stage of our walk represents the life-span of Tiamat, from birth to death. Reflect on the fact that all of us here have arisen from her ashes – we are star-dust.



Ancestral sun, do you remember us,  
Children of light, who behold you with living eyes!  
Are we as you, are you as we! It seems  
As if you look down on us with living face:  
Who am I who see your light but the light I see,  
Held for a moment in the form I wear, your beams.  
I have stood on shores of many seas,  
Of lakes and rivers, and always over the waters,  
Across those drowning gulfs of fear  
Your golden path has come to me  
Who am but one among all who depart and return.  
Blinding sun, with your corona of flames, your chasms of fire,  
Presence, terrible theophany,  
Am I in you, are you in me,  
Infinite centre of your unbounded realm  
Whose multitudes sing Holy, Holy, Holy?  
Do you go into the dark, or I?

*Kathleen Raine*

## **Stage 7 - 10 Steps (total 1820) 9,350 to 9,400 million years**

We have reached the point in our journey marking the birth of our star, the Sun. Through the unpredictable variations in the gravitational field a slightly denser than normal cloud of gas, mostly hydrogen, is formed in an arm of the Milky Way spiralling out from its centre. Its gravitational field starts sweeping more and more gas into its orbit, eventually growing to a mass of 2000 million, million, million, million tonnes, forming a middle sized star with a potential life of some ten billion years. Our sun is about 25,000 light years from the centre of the Milky Way, about half way between the centre and the edge.

*We have now covered 9,400million years of our cosmic journey (1880 steps) and we have reached the origin of the Earth / moon system and the other planets of our solar system. From here on it makes more sense to indicate the passage of time by counting down to the present. We are at a point 4,600million years ago and we have 920 steps to go to bring us up to the present.*

## **Stage 8 - 40 Steps (total 1860) 4,600 to 4,400 million years ago**

A disk of gas and dust, including some of the embers of Tiamat, surrounds the newly formed sun. Near the sun the disk consists largely of particles of iron and rock, further away from the sun it consists of water and gas. Within the disk, denser regions emerge which sweep up more matter through gravitational attraction. This is a progressive process, the coherent masses gradually getting larger and fewer. This is how the planets are formed. The aggregation of the coherent masses to form the Earth takes about 40 million years (8 steps of our walk). About ten million years later a slow collision with a large remaining mass produces the moon. As the Earth is relatively close to the sun it originally consists almost entirely of iron and rock. Virtually all the water and most of the carbon on the Earth arrive through collisions with comets which form in the outer regions of the original disk. For the remaining steps of this stage the Earth is constantly bombarded by comets. Its surface is covered with craters, like those on the moon. Think about the long slow building of the Earth, an incredibly hot seething mass of molten iron, rock, steam and gas.

## Stage 9 - 80 Steps (total 1940) 4,400 to 4,000 million years ago

The next 200 million years sees the consolidation of the Earth. There are fewer collisions with comets and the Earth stabilises into more or less its existing form with a core of iron, a mantle of semiliquid rock, a crust of solid rock and water and an atmosphere of carbon dioxide, nitrogen and water vapour.

We are walking along a line representing the passage of time from its beginning to the present. This helps us to think about the universe story as a sequence of transformations of matter into ever more complex and interdependent forms. In practice many of the transformations involved are cyclical and this is particularly true of the Earth. While the Earth was forming, matter was being swept up into it by gravitational attraction, and in the early period the surface of the Earth was still hot enough for some of the lighter elements, particularly hydrogen, to escape back into space. But as from about now planet Earth becomes virtually a closed system. In the broadest terms the subsequent history of Earth has to be considered in terms of cyclical transformations of matter driven by the conversion of energy from the sun. This arrives as short wave radiation centred on the visible spectrum of light and is emitted as longer wave infra-red radiation which we feel as heat.

The cooling continues, the first oceans begin to form and **the first of the major Earth cycles** is established: this is **the cycle of water**. Water evaporates from the surface of the Earth and enters the atmosphere where it cools and condenses to form clouds and rain which falls back onto the surface. The water begins to gather into seas and oceans.

Think about what it means for the earth to be a closed system.



## **Stage 10 - 20 Steps (total 1960) 4,000 to 3,900 million years ago**

The Earth is now 600 million years old. Granite outcrops near the Great Slave Lake in Canada date from this period. The surface of the Earth now has massive continental plates separated by oceans. These plates effectively float over a partially molten layer and are moved around, dragged by convection currents below the surface. The movement is very slow, on average only 5 cm per year. This is about the same rate as the growth of our fingernails. In terms of our walk the movement is much faster, it is a hundred miles for every step we take. These movements established **the second of the major Earth cycles; the cycle of rock**. Where two continental plates move apart, new rock is formed by upwelling from the molten core to form an ocean floor. Where two plates converge, the ocean floor is squeezed back into the molten core. Where two plates collide mountains are pushed up. The continental plates or parts of them may be covered by shallow seas. This slow movement of continents continues throughout the rest of our walk and still goes on today. Think about an earth on which the continents are different shapes and in different places from the ones we know.

## **Stage 11 - 10 Steps (total 1970) 3,900 to 3,850 million years ago**

The Universe is just over 10 thousand million years old and we are nearly three quarters of the way through our cosmic journey. Think back to the beginning of our walk. Think about all that has happened so far, because we have reached one of the most significant events in that story. It is practically certain that **life** started at some time during the next 50 million years. There are limestone sediments of this age in West Greenland in which the ratio of isotopes of carbon is characteristic of having come from living organisms. It almost certainly happened in the shallow waters of the sea. It seems likely that naturally produced globules, tiny bubbles of water surrounded by a fatty skin, provide a favourable environment for naturally occurring organic chemicals to organise themselves. Some of these manage to become self-sustaining by exchanging materials through the lipid layer. Some of these grow, and as they do so

the lipid globules become unstable and divide themselves. We have to begin to use the language of life and call these minute globules cells. At first the reproductive process is very hit or miss. By no means all the daughter cells contain all the necessary materials to continue growing. Through trial and error over millions of years a particular strain of cells, but maybe only one particular cell, produce chemicals known as nucleic acids which in effect carry information about how to make the materials necessary for maintenance and growth. By passing copies of these nucleic acids to the daughter cells they achieve not only reproduction but replication. Each daughter cell is the same as its parent. The current consensus of opinion is that just one quasi-living cell made this final step, or if there were others, the progeny of one single cell out-competed them. Over the next ten steps, think about this one, unique, minute bubble of life, the ancestor of all living things, including ourselves.

### **Stage 12 - 50 Steps (total 2020) 3,850 to 3,600 million years ago**

From that single cell probably living in shallow water, we see the beginning of the diversity of life in the first Kingdom of living organisms, the MONERA or bacteria. For the next 900 million years (180 steps) the bacteria are the only life forms on the planet, living only in the seas. Life on land is not possible because of intense ultra-violet radiation from the sun. The process of life requires energy and the early bacteria harness the energy of naturally occurring chemical reactions. The bacteria absorb the chemicals and allow the reactions to take place inside them. For a long time, life is on a knife-edge, with every individual cell totally dependent on finding the right chemicals to maintain itself.

### **Stage 13 - 120 Steps (total 2140) 3,600 to 3,000 million years ago**

The Earth is a 1000 million years old and there is definite fossil evidence for widespread life. Stromatolites dating from this time have been found in what is now South Africa and Australia. Stromatolites are rocky cushions associated with complex bacterial films constituting interdependent communities. Living ones are still found today. The next 600 million years sees the major diversification of bacteria. The main evolutionary

process is the development of different biochemical systems and pathways processing hydrogen sulphide, ammonia and methane. Over time, naturally occurring chemical sources of energy become scarce and some bacteria evolve the means of using the energy from light together with hydrogen from hydrogen sulphide to transform carbon dioxide to sugar and water; sulphur is produced as a waste product. Later, a group called the cyanobacteria, evolve the process of using hydrogen from water. This leads to the production of free oxygen as a waste product. Life begins to achieve a measure of autonomy, living things begin to depend on other living things and communities are born. There is now established **the third of the major Earth cycles: the cycle of living and dying**, eating and being eaten, and the recycling of the materials of dead organisms back into living ones. Think about an earth inhabited only by an incredible diversity and abundance of bacteria.

### **Stage 14 - 60 Steps (total 2200) 3,000 to 2,700 million years ago**

We now celebrate the possible appearance of the second Kingdom of living things, the PROTOCTISTA. Degradation products of steroids have been detected in shale-oil from this period in Australia. Steroids are associated with the membranes of nucleated cells and are not present in bacteria. Protoctists emerge by a process of symbiotic combination of bacterial cells. Most protoctists are singlecelled, microscopic, creatures although many form clearly visible colonies, and some of them, which we know as sea-weeds, can become large with fairly complicated anatomies. For the next 2000 million years (400 steps) the protoctists and bacteria are the only living organisms. Even today they are by far the most numerous of organisms. Each one of us has within and on our bodies more bacterial and protoctist cells than we have human cells. During this stage let us celebrate them. It is their slow and patient work that makes possible the subsequent developments of life on Earth.

## **Stage 15 – 40 Steps (total 2240) 2,700 to 2,500 million years ago**

We are now about four fifths of the way through our journey. The photosynthetic activity of the cyanobacteria begins to be significant. The oxygen they produce begins to play an important role in geochemical processes. Large deposits of iron ore begin to form by the oxidation of iron in solution in the seas and oceans. At the same time free oxygen begins to accumulate in the oceans and this causes a major transition in the pattern of life. Oxygen reacts naturally with many of the chemicals used by many bacteria as sources of energy. These bacteria have to find habitats substantially free of oxygen, hidden away in mud and inside the bodies of other organisms. Nevertheless, they play a vital role in recycling dead organic matter. Let us remember the hidden ones.

## **Stage 16 - 60 Steps (total 2300) 2,500 to 2,200 million years ago**

We are about half way through the story of the Earth. There is the first fossil evidence for the existence of Protoctista. The photosynthetic oxygen producers increase in abundance and organisms evolve which use the free oxygen in the biochemical process of transforming sugars to produce energy: the process of respiration. Life is still confined to the seas and oceans but free oxygen begins to accumulate in the atmosphere and **the fourth of the major Earth cycles** is established: **the atmospheric cycle.**

We now have in place the four major cycles of transformation: of water, of rock, of life and death and of the atmospheric gasses. Each of them is a complex of cycles within cycles and they are highly integrated within and between each other. The cycles vary enormously in both space and time dimensions. The slowest are the main cycles of rock that can take from millions to hundreds of millions of years. The largest is the cycle of an ocean current that circulates in a complicated path around the entire globe with a period of about one thousand years. The cycles of life and death take a few tens of minutes for many bacteria, up to several thousand years for the oldest trees. The enormous variation in period and scale of these cyclical transformations means that the system will never

get stuck in a groove and repeat the same sequence of events for ever.

### **Stage 17 - 100 Steps (total 2400) 2,200 to 1,700 million years ago**

Developments in the sea begin to create the conditions for the emergence of life on land. Communities of free living planktonic bacteria are widespread, floating freely in the oceans. Life is no longer confined to shallow waters with the result that free oxygen becomes abundant in the atmosphere. A layer of ozone, which is a form of oxygen, forms in the upper atmosphere shielding the surface from ultra-violet light. This is a necessary condition for the emergence of life on the land. Let us celebrate the life of the seas and oceans that made possible life on land.

### **Stage 18 - 80 Steps (total 2540) 1,700 to 1,300 million years ago**

The first life on dry land appears. The first colonisers were bacteria. There is evidence of the formation on dry land of crusts of photosynthetic cyanobacteria.

In the sea, the Protoctista begin a major diversification. We are at the beginning of the emergence of the bewildering diversity of living things we see around us now.

We tend to regard biological evolution as involving progress, a process of ascent in which the higher, more complex forms evolve from and replace the lower. What actually happens as the story develops, is an ever increasing *diversity* of things coupled with ever more *elaborate patterns of relationship* between them. To this extent the evolutionary story can be said to exhibit progress, but the new manifestations of evolution always emerge from, build themselves out of and intimately incorporate the earlier. The existence of humans is absolutely dependent on the activities of bacteria and all the other emergent layers of living things together with their interactions with each other and with the non-living environment.



### **Stage 19 - 140 Steps (total 2620) 1,300 to 600 million years ago**

We have completed about nine tenths of our journey and we are about two thirds of the way through the story of the earth. The first photosynthesising Protoctists emerge by the symbiotic acquisition of photosynthetic bacteria which become transformed into chloroplasts. It is probably during this period that some groups of Protoctista evolve a form of reproduction involving **sex**, that is the fusion of genetic material from two individuals as a precursor to cell division. In some colonial forms, cells begin to differentiate and to specialise, performing separate functions in support of the colony as a whole. Later the process of reproduction is delegated to specialised cells in the colony. This inevitably leads to the phenomenon of natural death but at the same time opens up new possibilities for differentiation and the emergence of complexity in the form and structure of living organisms. As Goethe recognised, 'Life is nature's most exquisite invention; and death is her expert contrivance to get plenty of life.' On this stage, which is the last of the longer stages of our walk, think about Goethe's insight into life and death – the sweet and the bitter.

## **Stage 20 - 6 Steps (total 2626) 600 to 570 million years ago**

We have less than a twentieth of our journey still to go. But from here the story quickens because we have been able to uncover more of it. At some point during the next few steps the third Kingdom of living organisms emerges, the ANIMALS. The fossil record begins to contain sponges and corals and a remarkable development of different types of animals is under way. The process of sexual reproduction coupled with a multi-cellular structure opens up new possibilities for diversity and accelerates the process of the emergence of new species coupled inevitably with the extinction of existing ones. The processes do not proceed at uniform rates and species do not survive for similar periods of time. While the larger taxonomic groups, families and orders, may persist for quite long periods, with every step we take, about half of the species become extinct and a roughly equal number of new species emerge. Think about this.

## **Stage 21 - 14 Steps (total 2640) 570 to 500 million years ago**

We have a hundred steps to go and we enter the Cambrian period of the Palaeozoic Era. The system of named eras and periods was devised by geologists at a time when it was not possible to give absolute ages to rocks and fossils. They had to be content with a relative method of classifying and sequencing them. Even now when it is possible to assign an absolute time scale to the geological system it is still convenient to use the system of named periods. The lengths of the remaining stages of our walk will represent what is now known about the durations of the major geological periods. The opening of the Cambrian period is marked by the appearance in the fossil record of representatives of most of the major groups of animals including the first vertebrates. These are still confined to the seas and oceans. The Cambrian period also sees the beginning of a grouping of the major continental plates into the southern hemisphere.

## **Stage 22 - 12 Steps (total 2652) 500 to 440 million years ago**

We are at the beginning of the Ordovician period. Algae begin to colonise the land. There was also a substantial radiation of marine animals including the first fishes. Life begins to directly influence the cycle of rock as corals and crinoids (relations of starfish) and other shelled animals contribute to the formation of massive beds of what becomes limestone.

## **Stage 23 - 6 Steps (total 2658) 440 to 410 million years ago**

The beginning of the Silurian period sees emergence of the last two of the five kingdoms of living organisms, the PLANTS and the FUNGI. With these there is a widespread development of life on the land, adding new and complex patterns to the cycles of life and death. With land plants comes the formation of soils that modify the cycles of rock. Plants also take up water which evaporates from their leaves and speeds up the cycle of water. The first known freshwater fish are from this period. This is significant because it is from these that the land vertebrates are descended.

During the Silurian period the major land mass is a super-continent, called Gondwanaland, centred over the South Pole. Gondwana is a region of India where the typical flora of the continent was first recognised in the fossil record. The part of Gondwanaland that is now India did not arrive where it is now, causing the upthrust of the Himalayas, until the last three steps of our journey.

## **Stage 24 - 10 Steps (total 2668) 410 to 360 million years ago**

We are at the beginning of the Devonian period. Forests of ferns and other tree-like plants are widespread. The first insects emerge around the middle of the period, beginning the long co-evolutionary story of the association between plants and insects that we see today. In the sea there is a substantial radiation of fish including the ancestors of the bony fish which are the most abundant forms today.

## **Stage 25 - 14 Steps (total 2682) 360 to 290 million years ago**

We now enter the Carboniferous period. The first vertebrate animals, the amphibia, begin to inhabit dry land. The Devonian forests continue to flourish. Nearly all the coal found on Earth dates from this period. In the sea there is a substantial building of coral reefs. With so much carbon held in trees and in coral reefs there is a significant reduction in the concentration of carbon dioxide in the atmosphere.

## **Stage 26 - 9 Steps (total 2691) 290 to 245 million years ago**

We are at the beginning of the Permian period. This is a generally dry period on land, favouring the emergence of vertebrates reproducing by shelled eggs, the earliest reptiles, leading to dinosaurs, proto-birds, and the first mammals. The end of the Permian period is marked by the largest extinction event in the history of life. It is estimated that possibly more than three-quarters of all species become extinct. In the seas and oceans it was even more extreme, as many as 95% of all species of marine organisms met their end. There was a dramatic fall in sea level by as much as 150m, emptying many shallow sea areas. There is also a pronounced drop in the oxygen concentration in the atmosphere. It is now believed that the extinction was caused by a two stage increase in global temperature. The first stage was caused by the extrusion of some two million cubic kilometres of flood basalt in what is now Siberia. Carbon Dioxide released along with the basalt caused a temperature increase of 5–6 degrees Celsius. This warmed the seas and oceans enough to unfreeze enough methane held at the bottom of the seas to produce a temperature increase of a further 5–6 degrees. The whole process is believed to have taken about 100,000 years.

### **Stage 27 - 20 Steps (total 2711) 245 to 145 million years ago**

The beginning of the Triassic period sees the main continental plates grouped together forming a super-continent known as Pangea which is centred more or less over the equator. During the Triassic period these plates begin to separate leading to the pattern of continents that exists today. Life begins the slow recovery from the Permian catastrophe. It is the beginning of the age of the dinosaurs.

### **Stage 28 - 16 Steps (total 2727) 145 to 65 million years ago**

We are at the beginning of the Cretaceous period. The Atlantic Ocean begins to open. In the oceans, a group of photosynthetic Protoctists known as diatoms appear in significant numbers for the first time. These are today the dominant photosynthesisers in the marine plankton. Equally significant is the first appearance of flowering plants which become wide spread during this period. The land continues to be dominated by dinosaurs although mammals and birds are also present.

### **Stage 29 - 8 Steps (total 2735) 65 to 25 million years ago**

The end of the Cretaceous period and the beginning of the Cenozoic era sees another major extinction event, including the end of the dinosaurs. This was very probably caused by the arrival of a small asteroid off the coast of Mexico. The explosive impact threw a massive amount of ash and dust into the atmosphere which blocked out the sunlight so vital for life to flourish. The long slow recovery period sees a major diversification in the sea of bony fish and on land of mammals, birds and flowering plants. Also the diversity of insects and other invertebrates associated with these. This represents an unparalleled flowering of diversity of species and the beginnings of the flora and fauna familiar to us today.

### **Stage 30 - 4 Steps (total 2739) 25 to 5 million years ago**

With the beginning of the Miocene epoch we are very nearly at the end of our journey. The first widespread grasslands appear. These are a major factor in the diversity and abundance of mammals. Unlike most plants, grass leaves grow from the bottom. The tops of the leaves can be eaten without killing the plant. India collides with Asia and the upthrust begins to form the Himalayas. Africa pushes north and the Alps are born.

### **Stage 31 - 1 Step (total 2740) 5 million years ago to the present!**

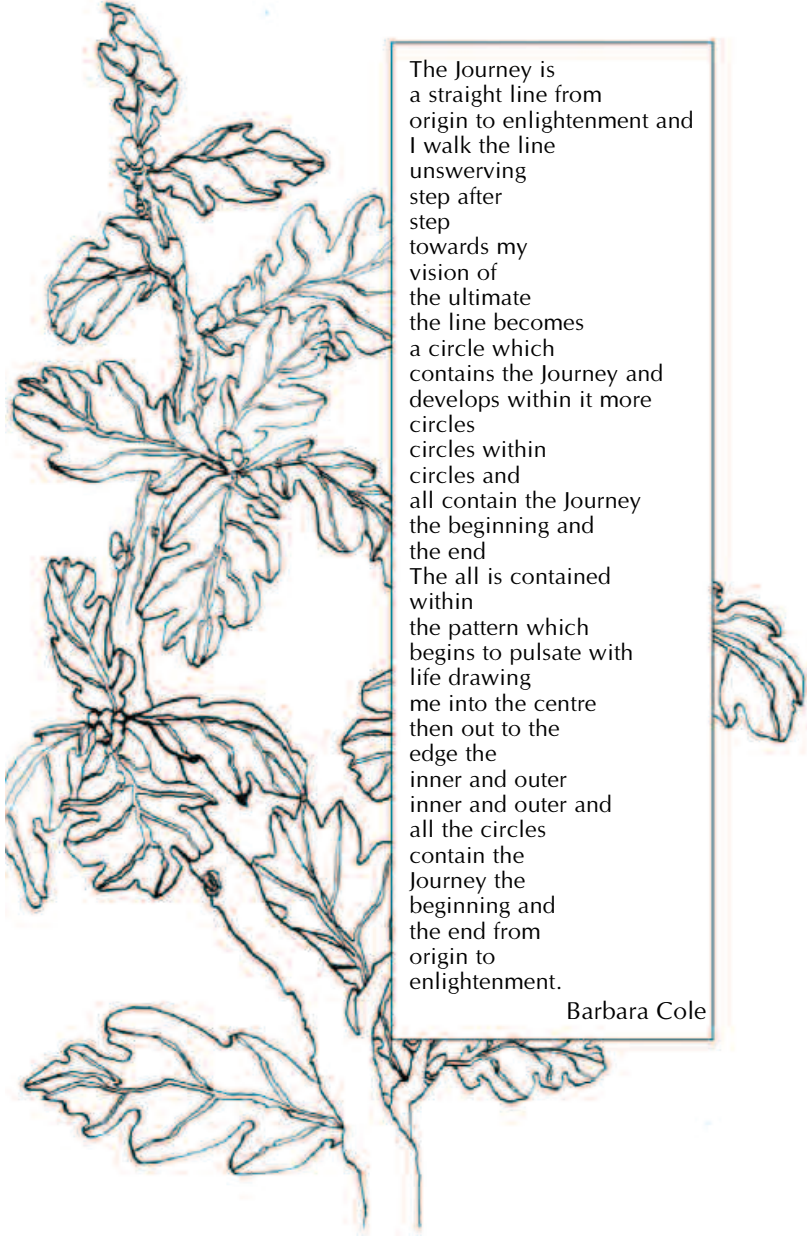
We have come to the last step of our journey, just 5 million years to go to bring us up to the present. Let us take this step bit by bit. Take one fifth of the step (10cm) – to 4 million years ago and *Australopithecus afarensis*, a smallish ape walking on two legs, emerges in Africa.

Take a second fifth – to 3 million years ago, ‘Lucy’ a young female *Australopithecus afarensis* is living in Ethiopia.

Take another fifth of a step – to 2 million years ago. *Homo habilis* emerges, also in Africa, *Homo habilis* starts making and using tools. Take another fifth of a step – to 1 million years ago and a second species of *Homo* emerges, *Homo erectus*, which is the first species in the human lineage to leave Africa and settle in Asia, Indonesia and Europe.

Now take just three-quarters of the last fifth of our last step (75mm) – to a quarter of a million years ago and *Homo sapiens* appears; the species to which we belong. We have just one twentieth of our last step (25mm) still to go.

Take a step of 20mm – and Cro-Magnon humans are producing their magnificent paintings in the caves of southern France. The last 5mm brings us to the present. The last thousandth of this last step, the last half a millimetre, represents the span of recorded human history.



The Journey is  
a straight line from  
origin to enlightenment and  
I walk the line  
unswerving  
step after  
step  
towards my  
vision of  
the ultimate  
the line becomes  
a circle which  
contains the Journey and  
develops within it more  
circles  
circles within  
circles and  
all contain the Journey  
the beginning and  
the end  
The all is contained  
within  
the pattern which  
begins to pulsate with  
life drawing  
me into the centre  
then out to the  
edge the  
inner and outer  
inner and outer and  
all the circles  
contain the  
Journey the  
beginning and  
the end from  
origin to  
enlightenment.

Barbara Cole

# The Short Walk

200m

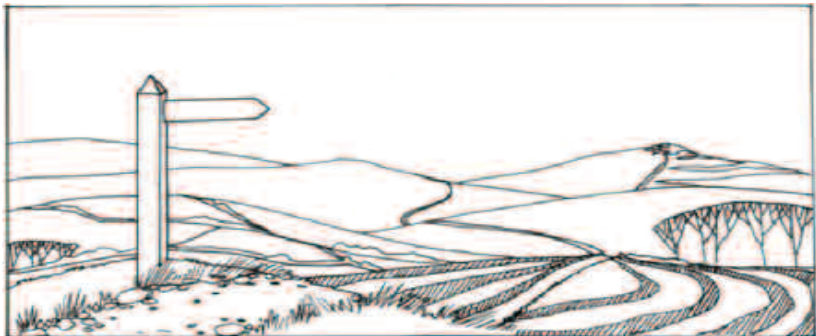
This walk was originally designed to be a permanent feature in a college campus with a series of fixed markers positioned at the beginning of each stage of the walk, but it can also be done almost anywhere, in a large garden or park, or in the wilderness, on a moor or by the sea.

The path can be straight or spiral or like the back cover or a mixture. It can be done alone or by a small group with one or two people reading the text.

The time represented by each step varies as the walk progresses. For the first stage each step is 67 million years reducing to just 1 million years at the end of the walk.

The walk will take about one hour.

Poetry reading, drumming or other musical accompaniment can be used to enhance the experience.



## In the Beginning

Nearly 14 thousand million years ago - was the Big Bang, only it wasn't. It certainly wasn't big in terms of size because there was no space in which size could exist. It certainly wasn't a bang because there was no time in which a bang could happen.

It is tempting to picture the birth of the universe from the outside as a minute, incredibly hot speck of something, exploding in space with a fantastic burst of energy and expanding in all directions at the speed of light. But this is a false image because the universe does not have an outside. In trying to describe the creation event, both language and imagination fail us. We are faced with the most incredible mystery. The best we can do is to say that something we can call the 'Stuff of the Universe' appears. From this space emerges, so that the universe could expand. Time emerges so that it could evolve. Forces emerge, which we recognise today as gravity, the electro-magnetic force and the nuclear forces, so that space could have structure and evolution be creative. In terms of the newly emergent dimension of time all this happens in the minutest of minute fractions of a second.

Our tiny universe is very, very, very hot. It is far too hot for matter to exist. But, as the expansion continues, it soon cools enough for matter to emerge. What happens is the spontaneous appearance of particle and antiparticle pairs. At first these destroy each other as fast as they appear. After another very, very small fraction of a second a minute asymmetry emerges and for every 3 billion annihilations one particle of matter survives. By the time the universe is one second old, all the antimatter is destroyed. The particles which survive are the building blocks of atoms and molecules – and there are enough of them to form all the galaxies and stars that now exist in the universe!

We might perhaps rephrase the Genesis story of creation and express the primordial event thus: 'and God took a deep breath and said "**behold**". And so it was that from the eternal **being** was born the first wondrous **becoming** of 'the Stuff of the Universe'. From this mysterious stuff emerged myriad possibilities in the form of matter and spirit and energy and space and time, all aspects of the same whole. And God saw that it was good, very good'.

## The stage is set. We can now start our walk — our journey through time.

The distance to the first stop is 8 meters, representing just over 1000 million years. Each pace is the equivalent of 67 million years. Let us see what happens during this time.

After about 300,000 years, just 3 cm of our walk, the universe becomes cool enough for positively charged protons and negatively charged electrons to pair up more or less permanently. The first atoms of hydrogen and helium emerge.

During the enormous destruction of matter in the first second in the life of the universe vast numbers of particles called neutrinos were formed, one for each particle/anti-particle interaction. Neutrinos do not interact with anything, they just buzz around the universe being neutrinos. Even today, there are about 100 million of them in every cubic metre in the universe, passing through each of us in large numbers and at high speeds as if our bodies were not there. In the relatively small early universe their density is much greater and they contribute significantly to the gravitational field. Their presence helps to give shape to vast clouds of hydrogen and helium, giving birth to the first galaxies within the first 500 million years. Galaxies are not uniformly spread throughout the universe but are structured into flattened clusters and groups within clusters.

The most stable form for a cloud of gas with its gravitational field is a more or less circular or elliptical disk and most galaxies take these forms. Within these young galaxies there are clumps of denser gas and their gravitational fields sweep in surrounding matter. Each of these coherent masses develops structure with an increasing density towards the centre. With increasing density comes increasing temperature and increasing pressure which opposes the compressive gravitational force. A clear structure emerges, and a **star** is born! The density and temperature at the heart of the star continues to rise until it gets hot enough for hydrogen atoms to fuse together to form helium. The temperature is about ten million degrees. This reaction produces more heat, increasing the pressure within the star. A balance is achieved between gravity compressing the matter of the star and the pressure in the star due to the heat generated by nuclear fusion. In our own star, the sun, about four and a half

million tonnes of hydrogen are fused into helium every second. Clearly this cannot go on for ever. Stars have limited lives; sooner or later gravity begins to win. For stars about the size of the sun, and up to ten times larger, the remaining hydrogen is blown off into space and all that remains is an incredibly dense core about the size of the earth. It becomes what astronomers call a white dwarf. For many stars the life from birth to effective death is about 500 million years.

On this stage of the walk think about the life and death of stars.

**First Stop: The Mystery of Gravity**  
**12,600 million years ago**

The distance to the next stop is 16 meters representing 2000 million years, each pace is about 63 million years.

All the time, new galaxies form and within these, new stars are born and die. The matter from dying stars is recycled into new ones. Behind all these processes and through the aeons of time is the force of gravity. Gravity plays a key role in the form of almost every macroscopic structure in the universe, from galaxies to rain drops. It is why trees grow up and roots grow down. Its influence is felt across the vast distances of galactic clusters as well as by apples hanging from trees. And yet it is one of the deepest mysteries of the universe. On this stage of the walk be aware of your own weight as you are drawn towards the centre of the earth. Think also about gravity on the cosmic scale. Thomas Berry describes gravity as the great compassionate curve within which the universe is enfolded.

**Second Stop: The Virgo Cluster**  
**10,600 million years ago**

The distance to the next stop is 24 meters representing 2700 million years and each pace about 56 million years.

At some time during the next few billion years our own galaxy, the Milky Way, is born. The Milky Way is just one of about a thousand galaxies forming what is known as the Virgo cluster. It is some two billion

light-years in diameter. Altogether there are about a hundred thousand million galaxies in the observable universe, and the Milky Way contains about a hundred thousand million stars.

On this stage of the journey you are invited to think about these enormous numbers and the vast expanses of space and time.

Think of all this as an essential preparation for what is to come. Following this stage we will progressively narrow our focus, to our own galaxy, then to our own star, the sun, and then to our own planet the Earth.

**Third Stop: The Milky Way**  
**7,900 million years ago**

The distance to the next stop is 32 meters representing nearly 3000 million years and each pace about 47 million years.

The Milky Way galaxy has the form of a flattish disk with spiral arms consisting mostly of interstellar gas. It is about a hundred thousand light-years in diameter. In addition to hurtling through space towards the centre of the Virgo cluster of galaxies, the Milky Way also rotates around its centre and each rotation takes 250 million years (7 paces). As the spiral arms swing around the centre of the galaxy they produce waves in the gravitational field. This produces favourable conditions for the formation of new stars. In this way new stars are constantly being born while others are dying. Many of the larger stars do not live long enough to complete an entire circuit. Think about the galaxy as a dynamic entity in which stars are born and live and die.

In time, we have already covered about two-thirds of the journey to the present.

**Fourth Stop: The Story of Tiamat**  
**4,900 million years ago**

The distance to the next stop is 6 meters representing about 500 million years and each pace about 39 million years.

During this stage we will consider the story of one star that lives its brief life at about this time in the history of the Milky Way. At its birth it is much larger than our sun and the death of such stars is dramatic. This par-

ticular star is now called Tiamat after the Babylonian goddess from whose dead body the sky and the earth were formed. It was during the death of this star that were forged most of the chemical elements that form the Earth. In such a large star the gravitational forces near the centre are massive. To oppose the gravitational forces, hydrogen is burned into helium, helium is burned into carbon, carbon is burned into oxygen. After millions of years the core of Tiamat is transformed into iron which is the end of the road, nothing more can be done to balance the titanic power of gravity and an incredibly violent implosion became inevitable. The shockwave causes an enormous explosion of the outer layers of the star and a week-long flash of brilliance visible right across the Milky Way galaxy. Vast amounts of the elements forged over millions of years in the nuclear furnace at the heart of Tiamat are blasted out into space. Not only hydrogen and helium but carbon and oxygen, nitrogen, sulphur and phosphorus, silicon and aluminium, copper and iron – all the elements that make up planet Earth, its atmosphere, its oceans, its rocks and its living things.

Within a time span of 150 million years Tiamat is born, flourishes and dies in an event of incredible violence, leaving a cloud of gas and dust some of which will soon be recycled and involved in the birth of our solar system. All this happens in just four paces of our walk.

### **Fifth Stop: The Sun and the Earth** **4,500 million years ago**

The distance to the next stop is 8 meters, representing 600 million years. Each pace is the equivalent of 38 million years.

We have now covered **9,200** million years since time began and now our own start, the Sun, is born. Through the unpredictable variations in the gravitational field a slightly denser than normal cloud of gas, mostly hydrogen, but including much of the remains of Tiamat, is formed in an arm of the Milky Way. Its gravitational field starts sweeping more and more gas into its orbit, eventually growing to a mass of 2000 million, million, million tonnes, forming a middle sized star with a potential life of some ten billion years. Our sun is about 25,000 light years from the centre of the Milky Way, about half way between the centre and

the edge. A disk of gas and dust surrounds the newly formed sun. Near the sun the disk consists largely of particles of iron and rock, further away from the sun it consists of water and gas. Within the disk, denser regions emerge which sweep up more matter through gravitational attraction. That is how the planets are formed. It takes about 40 million years (less than two steps of our walk) for Earth to become a coherent mass. About ten million years later a smaller mass of material collides with Earth and this produces the moon. As Earth is relatively close to the sun it originally consists almost entirely of iron and rock. Virtually all the water and most of the carbon on Earth arrive through collisions with comets which form in the outer regions of the original disk. For the next few steps Earth is constantly bombarded by comets, creating huge craters like those on the moon. Think about the long slow building of Earth, an incredibly hot seething mass of molten iron, rock, steam and gas.

Eventually over tens of millions of years the collisions decrease and Earth stabilises into more or less its existing form with a core of iron, a mantle of semi-liquid rock, a crust of solid rock and water and an atmosphere of carbon dioxide, nitrogen and water vapour. While Earth was forming, matter was being swept up into it by gravitational attraction, and in the early period its surface was still hot enough for some of the lighter elements, particularly hydrogen, to escape back into space. But as from about now planet Earth becomes virtually a closed system. From now on the history of Earth has to be considered in terms of cyclical transformations of matter driven by the conversion of energy from the sun.

When Earth is about 600 million years old, towards the end of the this stage of our walk, its surface consists of massive continental plates separated by oceans. These plates effectively float over a partially molten layer and are moved around, dragged by convection currents below the surface. The movement is very slow, on average only 5 cm per year. This is about the same rate as the growth of our fingernails. Where two continental plates move apart, new rock is formed by upwelling from the molten core to form an ocean floor. Where two plates converge, the ocean floor is squeezed back into the molten core. Where two plates collide mountains are pushed up. The continental plates or parts of them may be covered by shallow seas. This slow movement of continents continues throughout the rest of our walk and still goes on today. We expe-

rience it today through earthquakes and Tsunamis.

Think about an earth on which the continents are different shapes and in different places from the ones we know today.

**Sixth Stop: The Birth of Life**  
**3,900 million years ago**

The distance to the next stop is 21 metres representing 1400 million years. Each pace is about 34 million years.

The universe is just over 10 thousand million years old and we are nearly three-quarters of the way through our cosmic journey. Think back to the beginning of our walk. Think about all that has happened so far, because we have reached one of the most significant events in that story. It is almost certain that LIFE emerged at some time during the next 50 million years. There are limestone sediments of this age in West Greenland in which the ratio of isotopes of carbon is characteristic of having come from living organisms. There is a lot we don't know about how and where life started but it is very probable that it happened in the sea. Over the first few steps of this stage think about this one, unique, minute bubble of life, the ancestor of all living things, **including ourselves**.

From that single cell probably living in shallow water, we see the beginning of the diversity of life in the first Kingdom of living organisms, the BACTERIA. For the next 900 million years the bacteria are the only life forms on the planet, living only in the seas. Life on land is not possible because of intense ultra-violet radiation from the sun. The process of life requires energy and the early bacteria harness the energy of naturally occurring chemical reactions. The bacteria absorb the chemicals and allow the reactions to take place inside them. For a long time, life is on a knife-edge, with every individual cell totally dependent on finding the right chemicals to maintain itself. Then a group called the cyanobacteria, evolve the process we know of as photosynthesis, of using energy from the sun to split water into hydrogen and oxygen resulting in the production of free oxygen as a waste product. Life begins to achieve a meas-

ure of autonomy, living things begin to depend on other living things and communities are born, involving eating and being eaten and the recycling of the materials of dead organisms back into living ones.

As we approach the next marker new creatures emerge by a process of symbiotic combination of bacterial cells. We call them PROTISTIA. Most of them are single-celled, microscopic, organisms although many form clearly visible colonies, and some of them, which we know as seaweeds, can become large with fairly complicated anatomies. For the next 2000 million years the protists and bacteria are the only living organisms. Even today they are by far the most numerous of organisms. Each one of us has within and on our bodies more bacterial and protist cells than we have human cells.

**Seventh Stop: The Ozone Layer  
2,500 million years ago**

The distance to the next stop is 14 meters representing 700 million years and each pace is about 27 million years.

Developments in the sea begin to create the conditions for the emergence of life on land. Communities of free living planktonic bacteria are widespread, floating freely in the oceans. Life is no longer confined to shallow waters with the result that free oxygen becomes abundant. In the ocean this combines with iron to form most of today's deposits of iron ore. In the upper atmosphere a layer of ozone is formed. Ozone is a form of oxygen and the layer acts to shield the surface of the earth from ultra-violet light. This is a necessary condition for the emergence of life on the land. The dry land takes the form of massive continental plates some of which can be traced as the distant ancestors of today's land masses.

**Eighth Stop: Life on Land**  
**1,800 million years ago**

The distance to the next stop is 10 meters representing about 475 million years and each pace is about 23 million years.

We have completed about nine tenths of our journey and we are about two thirds of the way through the story of Earth.

The first life on dry land appears. The first colonisers were bacteria. There is evidence of the formation on dry land of crusts of photosynthetic cyanobacteria.

In the sea, the Protoctista begin a major diversification. We are at the beginning of the emergence of the bewildering diversity of living things we see around us now.

We tend to regard biological evolution as involving progress, a process of ascent in which the higher, more complex forms evolve from and replace the lower. What actually happens as the story develops, is an ever increasing *diversity* of things coupled with ever more *elaborate patterns of relationship* between them. To this extent the evolutionary story can be said to exhibit progress, but the new manifestations of evolution always emerge from, build themselves out of and intimately incorporate the earlier. The existence of humans is absolutely dependent on the activities of bacteria and all the other emergent layers of living things together with their interactions with each other and with the non-living environment.

**Ninth Stop: Natural Death**  
**1,300 million years ago**

The distance to the next stop is 20 metres representing 700 million years and each pace is 18 million years.

In some colonial forms of Protoctists, cells begin to differentiate and to specialise, performing separate functions in support of the colony as a

whole. Later the process of reproduction is delegated to specialised cells in the colony and life invents reproduction involving sex. This inevitably leads to the phenomenon of natural death but at the same time opens up new possibilities for differentiation and the emergence of complexity in the form and structure of living organisms. As Goethe recognised, ‘Life is nature’s most exquisite invention; and death is her expert contrivance to get plenty of life.’ On this stage think about Goethe’s insight into life and death – the sweet and the bitter.

**Tenth Stop: Animals**  
**600 million years ago**

The distance to the next stop is 6 meters representing 160 million years and each pace about 14 million years.

At some point during the next few steps the third Kingdom of living organisms emerges, the ANIMALS. These include sponges and corals flourishing in the seas and a remarkable development of different types of animals is under way. The process of sexual reproduction coupled with a multi-cellular structure opens up new possibilities for diversity and accelerates the process of the emergence of new species with the inevitable extinction of existing ones. The processes do not proceed at uniform rates and species survive for very variable periods of time but, on the whole diversity increases with time.

With each step we take on this stage nearly all the species that exist are replaced by others.

Almost immediately we enter the Cambrian period of the Palaeozoic Era. The system of named eras and periods was devised by geologists at a time when it was not possible to give absolute ages to rocks and fossils. They had to be content with a relative method of classifying and sequencing them. Even now when it is possible to assign an absolute time scale to the geological system it is still convenient to use the system of named periods.

At the opening of the Cambrian period we can see representatives of nearly all the major groups of animals including the first vertebrates. All the animals are still confined to the seas and oceans. We also see the be-

ginning of a grouping of the major continental plates into the southern hemisphere.

After 4 meters we enter the Ordovician period. Algae begin to colonise the land. The first fishes appear in the sea. Life begins to directly influence the cycle of rock as corals and crinoids (relations of starfish) and other shelled animals contribute to the formation of massive beds of what will become limestone.

The world is passing through the very first stages of becoming a world we might recognise today.

**Eleventh Stop: The First Soils**  
**440 million years ago**

The distance to the next stop is 10 meters representing 195 million years and each pace is about 10 million years.

We are now in the Silurian period when the last two of the five Kingdoms of living organisms emerge: the PLANTS and the FUNGI. These are primarily terrestrial organisms and they add new and complex patterns to the cycles of life and death. Lichens pioneer the formation of soils and speed up the cycles of rock. Plants take up water which evaporates from their leaves which speeds up the cycle of water. The first fish move into freshwater. It is from these that the land vertebrates are descended.

During the Silurian period the major land mass is a super-continent, called Gondwanaland, centred over the South Pole.

After 2 meters (4 paces) we enter the Devonian world. Forests of ferns and other tree-like plants are widespread. The first insects emerge around the middle of the period, beginning the long co-evolutionary story of the association between plants and insects that we see today. In the sea there is a substantial radiation of fish including the ancestors of the bony fish which are the most abundant forms today. The original form of the rock beneath our feet dates from this period.

After another three meters we enter the Carboniferous period. The first vertebrate animals, the amphibia, begin to inhabit dry land. The Devon-

ian forests continue to flourish. Nearly all the coal found on Earth dates from this period. In the sea there is a substantial building of coral reefs. With so much carbon held in trees and in coral reefs there is a significant reduction in the concentration of carbon dioxide in the atmosphere.

Three meters more and we enter the Permian period. It is a dry period on land, favouring the emergence of the earliest reptiles, leading to dinosaurs, proto-birds, and the first mammals. The end of the Permian period is marked by the largest extinction event in the history of life. It is estimated that at least half and possibly more than three-quarters of all animal species become extinct. In the seas and oceans it is even more extreme, as many as 95% of all species of marine organisms meet their end. It seems that for some reason yet unknown there was a very substantial global warming event resulting in a dramatic fall in sea level by as much as 150m, emptying many shallow seas. There is also a pronounced drop in the oxygen concentration in the atmosphere.

On a geological time-scale these events are catastrophic, but if any of us had been alive at the time we may not have been aware that anything special was happening.

### **Twelfth Stop: The Age of Reptiles** **245 million years ago**

The distance to the next stop is 6 meters representing 100 million years and each pace is 8 million years.

We have reached the beginning of the Triassic period. We are standing on a super-continent called Pangea which is centred more or less over the equator. During the Triassic period its plates begin to separate leading to the pattern of continents that exists today. Life begins the slow recovery from the Permian catastrophe. In the Triassic seas swim the large ichthyosaurs and plesiosaurs. On land the first dinosaurs appear.

After two meters we enter the Jurassic period. The dinosaurs are the dominant land animals.

Our walk started 13 billion 500 million years ago. We have just 200 million years to go before we reach the present.

**Thirteenth Stop: The Age of Dinosaurs**  
**145 million years ago**

The distance to the next stop is 6 meters representing 80 million years and each pace is 6 million years.

We are at the beginning of the Cretaceous period. The Atlantic Ocean begins to open. In the oceans, a group of photosynthetic Protoctists known as diatoms appear in large numbers for the first time. These are today the dominant photosynthesisers in the marine plankton. Equally significant is the first appearance of flowering plants which become widespread during this period. The land continues to be dominated by dinosaurs although mammals and birds are also present.

**Fourteenth Stop: The Yukatan Asteroid**  
**65 million years ago**

The distance to the next stop is 12 meters representing 60 million years and each pace is 3 million years.

At the end of the Cretaceous period and the beginning of the Cenozoic era we witness another major extinction event. It is the end of the dinosaurs. This was very probably caused by the arrival of a comet or small asteroid off the coast of Mexico. The long slow recovery period sees a major diversification in the sea of bony fish and on land of mammals, birds and flowering plants. Also the diversity of insects and other invertebrates associated with these. This represents an unparalleled flowering of diversity of species and the beginnings of the flora and fauna familiar to us today.

After 10 meters we enter the Miocene epoch and we are very nearly at the end of our walk. The first widespread grasslands appear. These are a major factor in the diversity and abundance of mammals. Unlike most plants, grass leaves grow from the bottom. The tops of the leaves can be eaten without killing the plant.

India collides with Asia and the upthrust begins to form the Himalayas. Africa pushes north and the Alps are born.

We have just 5 million years to go but only now do we enter a world with a more or less familiar geography.

The distance to the present is just 2 meters representing 5 million years and each pace just over one million years.

**Fifteenth Stop: The Emergence of Humans  
5 million years ago**

Let us take this stage one small step at a time.

Take one small step (40cm) – to 4 million years ago and *Australopithecus afarensis*, a smallish ape walking on two legs, emerges in Africa. Take a second small step – to 3 million years ago, ‘Lucy’ a young female *Australopithecus afarensis* is living in Ethiopia.

Take another small step – to 2 million years ago. *Homo habilis* emerges, also in Africa. *Homo habilis* starts making and using tools.

Take another small step – to 1 million years ago – and a second species of *Homo* emerges, *Homo erectus*, which is the first species in the human lineage to leave Africa and settle in Asia, Indonesia and Europe.

Now take just an even shorter step of just 30 cm to a quarter of a million years ago and *Homo sapiens* appears, the species to which we belong. We have just 10 cms still to go.

Take a step of 8 cms – and Cro-Magnon humans are producing their magnificent paintings in the caves of Lascaux in southern France.

The last 2 cms brings us to the present of which the last 2 millimetres, represent the span of recorded human history.

## The Great Epic Of Evolution

After reading Thomas Berry's *Evening Thoughts*, I was struck by his conviction that any liturgy of a Celebration of the Universe should include the Epic of Evolution which he sees as the primary revelatory experience.

I decided to have a go at producing one. I use the ancient "I am" format to convey the sacredness of the Epic to the reader/listener.

Erna Colebrook

I AM who I am	I am creator and destroyer
I am the Mystery of time	I am a galaxy called the Milky Way
I am the ground of being and becoming	I am a brilliant star ageing and imploding
I am inexhaustible energy	I am reborn as the sun and the planets
I am the first particles spinning at the edge of being	I am the emerging, enfolding, spirited embrace
I am the ever expanding spaces and connections in between	I am the dance of the Universe.
I am creative freedom	I am millions of years passing, and space forever growing
I am the emerging, enfolding, spirited embrace	I am a fierce sun
I am primordial reality	I am a young planet Earth
I am the evolving form and fullness of the Universe.	I am a naked mountain
I am aeons of time passing and space forever growing	I am a rushing stream
I am hot clouds of hydrogen giving birth to billions of stars	I am a warming sea
I gather them into immense swirling galaxies	I am tiny bubbles floating and dividing
I am old stars ageing and exploding	I am the mystery of life, death and rebirth
I am limitless potential for transformation	I am countless life-forms emerging into being
	I am evolving reality
	I am the emerging, enfolding, spirited embrace.

I am millions of years passing  
I am a self-regulating, intercon-  
nected, transformative planet  
I am the Gaian cycles of rock,  
water and air,  
interacting with life-forms  
I am the web of life  
I am growing complexity and  
growing awareness  
I am evolving reality  
I am the emerging, enfolding,  
spirited embrace.

I am primeval plankton  
I am a delicate jelly-fish  
I am a fish of the Devonian era  
set in stone  
I am the song of the humpback  
whale  
I am a coral reef slowly dying  
I am the community of life in the  
ocean  
I am life-forms forever renewing.

I am a patch of lichen on a rock  
I am a forest of tree ferns dying  
into coal  
I am an evergreen pine tree  
swaying in the wind  
I am a prickly cactus waiting for  
some rain  
I am an enchanting meadow full  
of ox-eye daisies  
I am a grain of wheat dying to be  
reborn.  
I am a cheeky magpie

I am a bright green parrot  
I am a South American condor  
I am the passenger pigeon hunted  
to extinction  
I am an exquisite humming bird  
I am a swarm of hungry locusts  
I am a Brimstone butterfly  
I value each and every one.

I am a fiercely beautiful tiger  
I am a slow slithery snake  
I am an endangered Orang-Utan  
I am a colony of industrious  
termites  
I am a family of elephants  
I am a mother cheetah who needs  
to feed her young  
I am parched African savannah  
I am an emerging human  
community.

I am the source of all things  
I am at the heart of all things  
I seek form and fullness in all  
things  
I am Sacred Mystery enfolding all  
things.

I am hope  
I am compassion  
I am NOW  
Go there.

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## Appendix: Scaling the Walk for lengths other than 1.37 Km

Stage	AMY	MYA	Steps	Per Stage
	0	13700	0	
1	500	13200	43	43
2	1000	12700	86	43
3	3000	10700	257	171
4	8650	5050	767	510
5	8900	4800	789	21
6	9050	4650	801	13
7	9100	4600	806	4
8	9300	4400		
9	9700	4000		
10	9800	3900		
11	9850	3850		
12	10100	3600		
13	10700	3000		
14	11000	2700		
15	11200	2500		
16	11500	2200		
17	12000	1700		
18	12400	1300		
19	13100	600		
20	13130	570		
21	13200	500		
22	13260	440		
23	13290	410		
24	13340	360		
25	13410	290		
26	13455	245		
27	13555	145		
28	13635	65		
29	13675	25		
30	13690	10		
31	13700	0		

It is not difficult to scale the walk for other lengths and time scales. The method given here assumes a single step of 0.5m

Construct a table (or open a spread sheet) and enter the figures in the first three columns of the table given here.

AMY is Age in Millions of Years.

MAY is Millions of Years Ago

Calculate a value  $K = 13700 / (2 \times (\text{length of walk in metres}))$ . The value K represents the millions of years per step.

In the column Steps enter  $AMY / K$  rounded to the nearest whole number In the column headed per stage enter the differences between the successive entries in Steps.

Substitute the new step counts in the walk text

For shorter walks, the text of the last step may have to be altered to fit the new scale.

As an example the step data for the first few stages for a walk of 600m have been entered

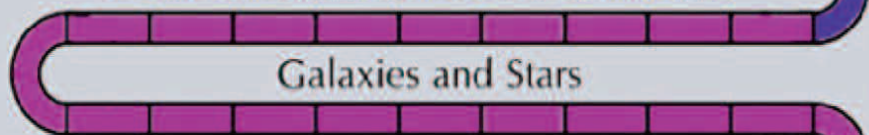


# THE TIME SNAKE

The Beginning



Each row is a Billion years, each segment is 100 Million years



Galaxies and Stars



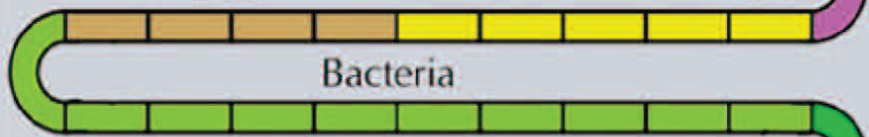
Milky Way Galaxy



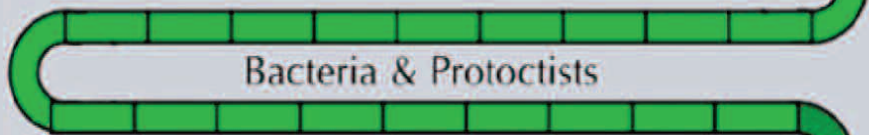
Tiamat

Earth

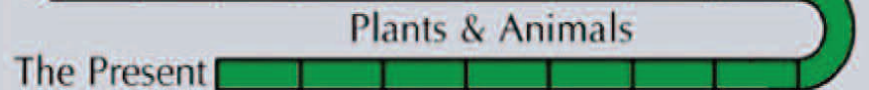
Sun



Bacteria



Bacteria & Protocists



Plants & Animals

The Present