

Down to Earth

Martin Bott - Geologist

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Born 1926. Educated Clayesmore School and Magdalene College, Cambridge.

Professor of Geophysics, Durham University, 1966-88.

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Let me first introduce myself. I was born in 1926, and my younger brother Oliver and I were brought up in the small Staffordshire village of Rough Close, just south of Stoke-on-Trent. Our father worked on the commercial side of a small pottery manufacturing company and Mother had been a primary schoolteacher before marriage. Our schooling was at first local, but when I was twelve my brother and I went away to Clayesmore School in Dorset. This was a fairly free and easy school and our interest in outdoor activities, such as walking and cycling in the beautiful Dorset countryside, was encouraged. As a result of a small school expedition to North Wales I was quite bitten by the rock climbing bug although my attainments were modest. My interest in science started much earlier, when I found my mother's old school chemistry book, which was very outdated no doubt, but fascinating to me. Later, at Clayesmore, mathematics and physics displaced chemistry as the focus of interest, after experience of some of the pitfalls of practical chemistry. On leaving school there was National Service to be done, and I joined the Royal Signals. I was fortunate to be sent to East Africa, and was stationed for a year just under Kilimanjaro. With my mountaineering and exploring interests, this was an ideal posting and I enjoyed expeditions on Kilimanjaro, Mt Kenya and Mt Meru. After demobilisation, I went up to Cambridge in 1948 to read mathematics, but after a few weeks changed to natural science with a view to physics. The mountaineering club was otherwise my main focus of interest as an undergraduate. The opportunity occurred to take part in a geological expedition to Spitzbergen in the summer of 1949 (and again in 1951). The result was that I ended up in the earth sciences rather than pure physics. My PhD topic concerned the use of geophysical methods to study the foundations of the Northern Pennines. I have never regretted my scientific migration to geophysics as it has enabled me to combine interests in physical science with outdoor activities. My work in earth science has also been in a most exciting period, with the plate tectonic revolution occurring during the 1960s, and the introduction of computers which are now central to most geophysical work.

I joined the Department of Geology in the University of Durham in 1954, first as a Research Fellow, then subsequently as Lecturer (1956), Reader, (1963) and Professor of Geophysics (1966). I retired as a full-time member of staff in 1988 but am continuing in a part-time research post. During my time in Durham I have been responsible with colleagues for the introduction of geophysics teaching, including an MSc course and a BSc course in geology and geophysics. I have maintained my early research interests in the deep structure of the British region, but have also been involved in marine geophysical investigations of the structure and evolution of the North Atlantic region, and in more theoretical studies of geodynamic processes such as the mechanism of plate tectonics and the origin of stress in the outer layers of the earth. At Durham, I have much enjoyed the combination of teaching and research, and in particular I have found it to be a great privilege and stimulus to work with research students.

My first introduction to Christianity was at home and during my early schooling. I remember being particularly enthralled when I first went to school by the short Scripture lessons outlining the Old Testament story from Abraham to Joshua. Later, my brother and I accompanied our parents to church in the nearby country village of Modershall, to which we used to walk on Sunday afternoons. As far as I am aware, I accepted the claims of Jesus to be the Son of God and the Truth of the Resurrection throughout my boyhood, but my interests in outdoor activities and science were much more central to me. I was

confirmed at Clayesmore when I was about seventeen, and although the importance of the step we were taking was emphasised, I don't think it had much effect on me, and I certainly did not understand what it was all about. When I left school to join the forces, my lack of real commitment showed up as I rarely attended church during my National Service years, although I resumed on going up to Cambridge.

Another important strand came into play in my late teens and early twenties, during National Service and university. My mother had told us how King George V had read a chapter of the Bible each day of his life. In some inexplicable way, this encouraged me to start reading the Bible myself, particularly the New Testament. One point which particularly struck me was the way in which St Paul had written to the young churches as groups of believers whose lives had been radically changed and reorientated as a result of a living experience of Christ. This did not tally well with my own rather formal experience of Christianity. My concern was borne out when I got to know two committed Christian friends while training at Catterick Camp; one had been a Christian since childhood and the other had been converted during a confirmation service at Catterick. Later, at Cambridge, the lives of friends from the Christian Union similarly testified to their real faith. It thus became apparent to me from reading the Bible and from the witness of Christians that there was something missing from my own commitment, but I did not realise what this was at that time.

I also had a significant experience during the Cambridge Spitzbergen expedition of 1949, when twelve of us spent most of the long vacation exploring the geology of part of this Arctic island. We were based on Billesfjord in the south-west of the island, but a party of five of us crossed the icecap, man-hauling two sledges, to explore the Stubendorf mountains and their geological structure. We were several days away from the base camp when this trip came to an abrupt end. All five of us were relaying one of the sledges up a steep snow slope on one of the Stubendorf glaciers, when the sledge broke through a snow bridge over a wide crevasse and pulled all of us down after it. The leader of the party broke his ankle in the fall (and later exhibited considerable courage in trekking back on skis over the icecap). The rest of us were unhurt as we landed on soft snow thirty to forty feet down the crevasse. We managed to climb out of the crevasse up a steep snow slope which had fallen in further along, but it took us most of a day to recover ourselves and our equipment. It was a very lucky escape, particularly since we had no radios and were quite out of touch with anyone else. That night, lying in our tents in the light Arctic summer night, I had a great experience of the goodness and providence of God, and I think this led me to a greater determination to seek him seriously. This time in Spitzbergen was also a turning-point in my career, as I had so much enjoyed the experience of combining science and exploration.

The greater turning-point, however, came during my second year as a research student, in autumn 1952. I had become increasingly concerned about my need for Christian commitment but did not understand how it could come about. The opportunity came with the week-long mission to the university organised by the Christian Union, with John Stott as the main speaker each evening. I attended the evening meetings in St Mary's Church and at the onset realized that here was the answer to my searching. During the talks I came to recognise how I had broken all the commandments in the deeper sense in which Jesus interpreted them, and that I had no power to do anything about it. As the message of the cross was explained, it was as if scales fell from my eyes. The cross had previously been an enigma to me, but now I understood for the first time how Jesus had died for me so that my sins could be forgiven and the barrier with God could thus be broken. At the end of one of the services, I yielded myself to Christ. As a result, joy and relief came flooding in. I have always looked back on this experience as my conversion, but I would not discount my previous experiences as they were all steps on the way.

Shortly afterwards I was faced by a testing time when I learned that difficulties in life do not all vanish on becoming a Christian, in fact to some extent they intensify. I was much helped by a small college Bible study group and by recruitment to help with a Christian summer camp for boys and with the Research Scientists' Christian Fellowship field courses for sixth-formers at Dale Fort in Pembrokeshire and elsewhere. It was at one of these courses that I met my wife Joyce, a botanist who was then working at the Freshwater Biological Station at Windermere. We were married in 1960 and now have three grown-up children. For most of our time at Durham we have belonged to St Nicholas Church, where I

am now a Reader. The fellowship in this church has been very helpful and supportive, particularly during the last ten years when we have been experiencing renewal.

One of the potential stumbling-blocks for an earth scientist is the apparent conflict between the early Genesis account of creation and the scientific record of the development of the earth and life on it. Strangely, this problem has never caused me any serious difficulty or doubt, but nevertheless it looms large in the popular view of things. In simple terms, the problem arises as follows. The biblical record has sometimes been taken to imply a very short timespan of creation, perhaps about 6,000 years according to Archbishop Ussher who lived in the seventeenth century. In contrast, the geological timescale as determined by radiometric dating (using the decay of long-live radioactive isotopes such as uranium and thorium isotopes, potassium-40, rubidium-87 and carbon-14 for the youngest rocks) gives an age of about 4,400 million years for the formation of the earth and ages within this timescale for individual rocks. This timescale is consistent with the slow observed rate of geological processes. Even if one accepts an extended timescale, the early Genesis order of creation differs somewhat from the geologically inferred order, and the fossil record together with other biological evidence strongly supports an evolutionary origin of species rather than by separate events such as literal interpretation of the early chapters of Genesis might suggest.

Some Christians have attempted to resolve these difficulties by accepting the Genesis story as a literal scientific account of the origin and evolution of the earth and of life. Consequently, the scientific record is reinterpreted to fit in detail into the Genesis story. This requires great convolutions of the mind. An early example of someone who did this is Phillip Gosse (1810-88), a distinguished naturalist and also a leading member of the newly-founded Plymouth Brethren. He completely rejected the whole concept of Darwinian evolution and was forced to interpret the bands of fossils in the sedimentary rocks of England as if they had been created in the rocks in their present situation. This type of approach continues to the present day, and is called scientific creationism. It leads to the inference that the present-day physical and biological processes cannot generally be extrapolated back into the past, despite overwhelming evidence that in general they can. It thus makes an almost complete nonsense of the subject of historical geology, and implies that practically all earth scientists (as well as astronomers) have been barking up the wrong tree for the last 150 years or so.

Now scientific hypotheses and even theories are often wrong or imperfect, but good hypotheses are open to testing by observation or experiment. Science progresses in this way, and is dependent on new ideas, however strange. Scientists often have to admit that they are wrong, but when theories have been very heavily tested they form part of the body of scientific knowledge in which a good degree of confidence can be placed. An example of this is the methods of radiometric age dating. There are certainly some problems with the methods, which can, in consequence, sometimes give erroneous results, but these can often be recognised by inconsistency with results from other methods, and so on. But it is beyond plausibility to imply that the methods are systematically in error by a factor approaching 1 million, unless the observed rates of radioactive decay have so changed over the last 6,000 years. It is for reasons such as this that earth scientists, including many Christians among them, find it difficult to accept the scientific creationist approach, when there is a very much simpler and self-consistent explanation.

How can the viewpoints of the Christian and the earth scientist be reconciled? Personally, I have never had any serious difficulty over this apparent enigma, and did not find that it deterred me from seeking Christian truth, except possibly as an excuse. I regard the Genesis story, perhaps as far as chapter 11, as a sort of parable which reveals great basic truths about the purposes of God and the nature of mankind without any requirement for them to be taken strictly literally. It tells us that God created the universe and all life, how he created mankind in his own image (possibly via the evolutionary process), how mankind has the potential to explore and exploit the earth but has a basic ingrained tendency to do wrong, resulting in separation from God. The great basic truths which are revealed here are unattainable by scientific investigation. They are equally recognisable in the story whatever one takes the literary form to be. It is written in a form accessible to people of all ages, and should thus obviously not be taken as a scientific account of creation. The natural details of the history of creation, however, are available

to ongoing scientific investigation of the sort which stems from the nature of creation and the God-given potential of mankind as revealed in Genesis and elsewhere in the Bible. On a more positive note, scientists are privileged to see how wonderfully the natural world is constructed, in all its complexity and beauty, and if they are Christians they respond by wonder and praise of the Creator.

The problems of science and faith discussed here have only arisen over the last hundred years or so, and consequently this has been a period of adjustment for our interpretation of some short but prominent parts of the Old Testament. Two practical issues which arise from these and related problems of science and faith need a mention. It seems important that Christians actively in contact with young people should be aware of the problems, and in particular should not press an interpretation of the early chapters of Genesis which conflicts with what is taught at school about the evolution of the earth and of life on it. Such a conflict may lead to a premature rejection of Christianity or to a compartmentalised understanding of Christian and scientific truth, which cannot be right. On the other hand, many older Christians who are not scientifically or otherwise academically inclined find it difficult and upsetting to adjust to a less literal interpretation. The last thing one would want to do would be to upset their faith, which is of much greater eternal significance than the propagation of scientific truth.

Scientists should be seeking the truth about the natural world in their work. Christians should also always seek the truth in all they do, including in their work. According to St John, Jesus was 'full of grace and truth', and he described himself to be 'the way, the truth and the life'. It is difficult, then, to see how there can be any real conflict between the creation by the Father, which can be explored by the scientist, and Christian truth as revealed in the Bible. Where there are apparent conflicts, then it seems that the reason must be our lack of understanding. And so, when confronted with other apparent conflicts over the Bible and natural knowledge of all kinds, the best approach seems to me to be 'reverent agnosticism', otherwise, we may raise unnecessary barriers which may deter others from seeking Jesus, who came to give those who come to him eternal life.

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