

EDITORIAL COMMENTS

The Society is proud to present its latest selection in the technical monograph series, *The Argument* by Bill Rusch. A wide range of topics is covered in this unique book. Dr. Rusch also contributes to this Quarterly first with a tribute to the late Dr. John Grebe, one of the founders of the Society, and second with a review of the anti-creationist book *Evolution versus Creationism*. The editor also adds a brief addendum to the Rusch review defending the use of thermodynamic principles by creationists particularly where these have been disputed by naturalists.

The invited article is an excellent piece of detective work by Dr. John Klotz in delving into an original Charles Darwin manuscript. This well-written paper forms a trilogy with two previous works by Bill Rusch (CRSQ, 12:99-102 and 21:37-39) indicating that Darwin never embraced any of the tenets of Christianity in the last years of his life.

Magnus Verbrugge finishes his three-part series on Duyvene De Wit focusing on the influence of the writings of Herman Dooyeweerd. Also Michael Oard completes his comprehensive series on a uniformitarian theory of the ice ages. He points out many technical and philosophical defects of uniformitarian reasoning.

Dr. Tom Barnes develops his classical model of the hydrogen atom further. Dr. Barnes and Brent Becker

have an interesting interchange in the letters to the editor. I would like to see physicists contribute their comments to the classical vs. quantum physics discussion and present the philosophical consequences. A book review by Dr. Richard Pemper on Barnes' book, *Physics of the Future*, is included in this issue.

The very readable educational column of John Moore contains a superb section on one aspect of the scientific method, i.e., measurement. Also Dr. Moore carefully outlines a limitation of scientific methodology, i.e., the origin of the universe is beyond scientific investigation. What a person believes about the origin of the natural world is a position of faith, not knowledge.

There are several selections in Panorama of Science. The editor uses this section, originated by Harold Armstrong, to include technical briefs. Often ideas for laboratory and library research are offered. The overthrust bibliography is continued in this issue. It is hoped some Society members will investigate certain of these geologic formations. Excerpts from a letter by David Tyler to British Creationists, discussing the Experiment Station concept of CRS, reveal that other men realize the need for more study on the Creation model of science in an organized fashion.

Emmett L. Williams

INVITED PAPER

DARWIN'S RELIGIOUS BELIEFS

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Abstract

*In his autobiography entitled **Recollections of the Development of My Mind and Character** prepared by Darwin for his children there is an extensive section on the development of his religious views. Though Darwin never intended the autobiography for publication, it was subsequently edited and published by his son, Sir Francis Darwin. In editing, Sir Francis Darwin omitted the section on his father's religious views and instead presented them as brief quotations accompanied by his own summary. The original handwritten autobiography is in the Cambridge University library. The author has used this manuscript as the basis for much of this article. In his early life Darwin was a committed Christian. Later he was much influenced by his father who expressed his skepticism quite openly. Another factor was Darwin's understanding of the Genesis account as teaching fixity of species so that when he became convinced that new species could arise he came to believe that the Bible was unreliable. Thus, as he grew older he left the camp of orthodox Christianity and became an agnostic.*

Introduction

Darwin's religious beliefs evolved and, like so much of the real world, deteriorated rather than progressed as the theory of evolution might suggest. There was a period in his life when he was quite orthodox, but he died a skeptic and apparently an unbeliever.

That such a change should have taken place may well have been due in part to his family background. His mother was a Unitarian and attended the Unitarian Church in Shrewsbury on High Street. However,

Darwin and others of the children were baptized in St. Chad's Anglican Church, and later he seems to have attended the Anglican Church rather than the Unitarian Church. His mother, Susannah Wedgwood, who was his father's first cousin, died in July 1817 when Darwin was a little over eight years old and does not seem to have had too great an influence on Darwin's upbringing and particularly on his religious views.

More important was the influence of Darwin's father, Robert Waring Darwin, a remarkably successful Shrewsbury physician. Biographers have puzzled over the influence of Dr. Darwin on his son. Some have suggested an estrangement, but this does not seem to have been the case. Actually it appears as if Darwin

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had a high regard and a genuine affection for his father and that throughout his life his goal was to satisfy and please him. Darwin's father was a skeptic though he seems to have kept his views pretty much within the family because they would have been quite unpopular in Shrewsbury. One of Darwin's reasons for questioning Christianity in his later years was the judgment it called down on unbelief such as his father expressed. In his handwritten *Recollections of the Development of My Mind and Character* which he penned for the private benefit of his children and which he apparently did not intend for publication, he writes:

I can indeed hardly see how anyone ought to wish Christianity to be true; for if so, the plain language of the text seems to show that the men who do not believe, and this would include my father, brother, and almost all my best friends, will be eventually punished, and this is a damnable doctrine.¹

Later he says:

Before I was engaged to be married, my father advised me to conceal carefully my doubts, for he said that he had known the extreme misery this caused with married persons. Things went on pretty well until the wife or husband became out of health, and then some women suffered miserably by doubting about the salvation of their husband, thus making them likewise to suffer. My father added that he had known during his whole life only three women who were skeptics; and it should be remembered he knew well a multitude of persons and possessed extraordinary powers of winning confidence.²

It would appear that as he grew Darwin was exposed to both the orthodoxy of the Anglican Church and the Socinianism of the Unitarian Church. Even in the latter the existence of a personal God was acknowledged, and it was recognized that He was the Creator of heaven and earth. Darwin's father apparently kept his doubts to himself when Darwin was young. Only in later years did he share his skepticism with his children. The *Recollections*, only a part of which have appeared in print, are particularly helpful in understanding the development of Darwin's own religious views.

Anglican Influence

Darwin seems at first to have grown more in the direction of Anglican theology than of the Unitarian point of view. He says, "Whilst on board the *Beagle* I was quite orthodox, and I remember being heartily laughed at by several of the officers (though themselves orthodox) for quoting the Bible as an unanswerable authority on some point of morality."³ Such a statement would certainly suggest that at this time in his life Darwin accepted the full authority of the Scriptures.

This orthodoxy of Darwin's seems to have been the result of a considered judgment of the claims of Christianity on his part when it was decided that he should attend Cambridge and become a clergyman. Darwin had disappointed his father at Edinburgh where he had been sent so that he might follow in his father's footsteps as a physician. It became apparent that Dar-

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on the point of morality. I suppose it was the
 necessity of ^{the} ~~the~~ ^{argument} ~~argument~~ ^{conscience} ~~conscience~~.
 (in 1836 & 1844)
 But I had gradually come to the ~~idea~~ ^{idea} to
 see that the Old Testament, from its manifest
 false history ~~and~~ ^{and} of the world, with the
 story of Babel, its plainness as a sign of man,
 & for its attributing to God the feelings of a
 merciful tyranny, was so much to be trusted
 than the sacred books of the Hindus, or the belief
 of my bookishness. It suited the contrary
 view before my mind & could not be denied,
 in it with the ~~idea~~ ^{idea} of God was not to make a
 revelation to the Hindus, and he found it to
 be connected with the belief in Vishnu, &c. &c.,
 as Unitarianism is connected with the Old Testament.
 This appears to be a very interesting subject.

Figure 1. Page 62 from original Darwin manuscript.

win did not want to follow a profession for which he was not suited, and so his father proposed that he attend Cambridge and become an Anglican clergyman. This was one of the few professions open to a gentleman. Darwin was a man of integrity, anxious to be sure that he could honestly accept that which he would be called on to preach, teach and confess. He writes:

I asked for some time to consider, as from a little I had heard or thought on the subject I had scruples about declaring my belief in all the dogmas of the Church of England; though otherwise I liked the thought of being a country clergyman. Accordingly I read with care *Pearson on the Creed*, and a few other books on divinity; and as I did not then in the least doubt the strict and literal truth of every word in the Bible I soon persuaded myself that our creed must be fully accepted.⁴ (Italics added.)

It is rather interesting that he describes Professor Henslow who had such great influence on him in the following way, "He was deeply religious, and so orthodox that he told me one day he should be grieved if a single word of the Thirty-Nine Articles were altered."⁵

Darwin married into the Wedgwood family. Just as his father had married his first cousin, Darwin married Emma Wedgwood who bore the same relationship to him. Like Darwin's mother, Emma was a Unitarian. However, at the Downe where they spent most of their lives, they attended the Anglican Church, St. Mary's,

and Mrs. Darwin is buried in the church yard there. There seems little doubt that Mrs. Darwin's views were more orthodox than those of her husband and that these were a major reason for Darwin's hypochondria, which almost all of his biographers acknowledge was due to the conflict between his religious views as reflected in his espousal of the theory of evolution and the more orthodox religious views of Mrs. Darwin. Darwin loved his wife very much, and it seems to have caused him a great deal of inner turmoil that he had advanced a point of view which she found objectionable from the standpoint of her religious beliefs.

What is it that brought the change from orthodox Christianity to skepticism and unbelief? It may be that Darwin was exposed to higher critical views at Cambridge, but this seems hardly likely in view of his orthodoxy at the time of the voyage of the Beagle. It is possible that he was disenchanted by the dryness and boredom of the Cambridge lectures in theology that he was required to attend. He writes, "During the three years which I spent at Cambridge my time was wasted, as far as the academical studies were concerned, as completely as at Edinburgh and at school."⁶

Doubts About Scripture

It is more likely that Darwin later came to recognize the incompatibility of his views on evolution with the Genesis account. This conflict was exacerbated by what he believed Genesis taught. He was convinced that the Bible taught fixity of species and was satisfied that once he had come to accept the idea of the development of new species in the course of the earth's history he was obliged to reject the Genesis account. The title of his book *Origin of Species By Natural Selection* shows that he was convinced that he had proved evolution because he had what he regarded as evidence for the development of new species.

To justify and support his point of view he began to look for reasons to question the entire Christian faith. In the remarkably frank *Recollections* he writes:

But I had gradually come by this time (i.e. 1836 to 1839) to see that the Old Testament, from its manifestly false history of the world, with the Tower of Babel, the rain-bow as a sign etc. and from its attributing to God the feelings of a revengeful tyrant, was no more to be trusted than the sacred books of the Hindoos, or the belief of any barbarian. The question then continually rose before my mind and would not be banished—is it credible that if God were now to make a revelation to the Hindoos, would He permit it to be connected with the belief Vishnu, Siva, etc. as Christianity is connected with the Old Testament? This appeared to me utterly incredible. By further reflecting that the clearest evidence would be requisite to make any sane man believe in the miracles by which Christianity is supported,—and that the more we know of the fixed laws of nature the more incredible the miracles become—that the men at that time were ignorant and credulous to a degree almost incomprehensible by us—that the gospels cannot be proved to have been written simultaneously with the events,—that they differ in many important details, far too important as it seemed to me to be admitted as the usual inaccuracies of eyewitnesses—by such reflections as these which I give not as having the least novelty and value, but as they influenced me I gradually came to disbelieve in Christianity as a divine revelation.⁷

Darwin goes on to protest that he did not wish to give up his faith. He writes:

But I was very unwilling to give up my belief—I feel sure of this, for I can well remember often and often inventing daydreams of old letters between distinguished Romans and manuscripts being discovered at Pompeii or elsewhere which confirmed in the most striking manner all that was written in the Gospels, but I found it more and more difficult with free scope given to my imagination to invent evidence which would suffice to convince me. Thus disbelief crept over me at a very slow rate but was at last complete. The rate was so slow that I felt no distress and have never since doubted even for a single second that my conclusion was correct.⁸

Darwin explains to his children some of the reasons for his doubts. He writes, "The fact that many false religions have spread over large portions of the earth like wild fire had some weight with me."⁹ I quoted a reference to Hinduism earlier.

Darwin also seems to have been influenced by the higher criticism of his day. He was led by researchers in the area of Biblical studies to doubt the authority and authenticity of the Scriptures. He writes, "Beautiful as is the morality of the New Testament, it can

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constant recollection of a belief in God &
 to much of children judging so strong &
 perhaps an indirect effect on them, ^{brain,} unless
 fully developed, ^{to} ~~to~~ is not in as
 explicit form as to those of this belief
 in God, & for a number to those of
 it is mistaken for a hatred of a man.
 I cannot pretend to throw the least light
 on such abstract problems. The mystery of
 the beginning of all things is insoluble to
 us; & I for one must be content to remain
 an Agnostic.
 (Edinb.)
 From my diary, Jan 29. 1889, a sentiment ^{from} ~~from~~ ^{to} ~~to~~
 being drawn & setting it down, Feb 14. 1892.—
 You see how wide your mother's & father's ground
 is, & how she has been true to all of you. She has

Figure 2. Page 73 from original Darwin manuscript.

hardly be denied that its perfection depends in part on the interpretation which we now put on metaphysical allegories."¹⁰

Religious Beliefs

In his *Recollections* he deals with two other aspects of his religious beliefs, the existence of a personal God and immortality. He writes:

Although I did not think much about the existence of a personal God until a considerably later period of my life, I will here give the vague conclusions to which I have been driven. The old argument from design in nature, as given by Paley, which formerly seemed to me so conclusive, fails now that the law of natural selection has been discovered. We can no longer argue that, for instance, the beautiful hinge of a bivalve shell must have been made by an intelligent being, like the hinge of a door by man. There seems to be no more design in the variability of organic beings and in the action of natural selection than in the course which the wind blows. Everything in nature is the result of fixed laws.

But passing over the endless beautiful and adjectives which we everywhere meet with it may be asked how can the generally beneficent arrangement of the world be accounted for? Some writers indeed are so much impressed with the amount of suffering that they doubt if we look to all sentient beings whether there is more of misery or of happiness,—whether the world as a whole is a good or bad one. According to my judgment happiness decidedly prevails, though this would be very difficult to prove. If the truth of this conclusion be granted it harmonizes well with the effects which we might expect from natural selection. If all the individuals of any species were habitually to suffer to an extreme degree, they will neglect to propagate their kind; but we have no reason to believe that this has ever or at least often occurred. Some other considerations, moreover, lead to the belief that all sentient beings have been formed so as to enjoy as a general rule happiness. Everyone who believes as I do that all the corporeal and mental organs (excepting those which are neither advantageous or disadvantageous to the possessor) of all beings have been developed through natural selection or the survival of the fittest together with use or habit, will admit that these organs have been formed so that their possessors may compete successfully with other beings and thus increase in number. Now an animal may be led to pursue that course of action which is the more beneficial to the species by suffering such as pain, hunger, thirst and fear; or by pleasure, as in eating and drinking and in the propagation of the species, etc.; or by both means combined as in the search for food. But pain or suffering of any kind if long continued causes depression and lessens the power of action; yet is well adapted to make a creature guard itself against any great or certain evil. Pleasurable sensations, on the other hand, may be long continued without any depressing effects; on the contrary they stimulate the whole system to increased ac-

tion. Hence it has come to pass that most or all sentient beings have been developed in such a manner, through natural selection, that pleasurable sensations serve as their habitual guides. We see this in the pleasure from exercise, even occasionally from great exertion of the body or mind, in the pleasure of our daily meals and especially in the pleasure derived from sociability and from loving our families. The sum of such pleasures as these which are habitual or frequently recurrent give, as I can hardly doubt, to most sentient beings an excess of pleasure over misery, although many occasionally suffer much. Such suffering is quite compatible in the belief in Natural Selection, which is not perfect in its action, but tends only to render each species as successful as possible in the battle for life with other species in wonderfully complex and changing circumstances.

That there is much suffering in the world no one disputes. Some have attempted to explain this with reference to man by imagining that it serves for his moral improvement. But the number of men in the world is as nothing compared with that of all sentient beings, and they often suffer greatly without any moral improvement. A being so powerful and so full of knowledge as a God who could create the universe is to our finite minds omnipotent and omniscient, and it revolts our understanding to suppose that this benevolence is not unbounded, for what advantage can there be in the suffering of millions of the lower animals throughout endless time? This very old argument from the existence of suffering against the existence of an intelligent first cause seems to me a strong one; whereas, as first remarked, the presence of much suffering agrees with the view that all organic beings have been developed through variation and natural selection.

At the present time the most usual argument for the existence of an intelligent God is drawn from deep inward conviction and feelings which are experienced by most persons. But it cannot be doubted that Hindoos, Mohammedans and the like might argue in the same manner and with equal fervor of the existence of their one God, or many gods or as the Buddhists of no god.

There are also many barbarian tribes who cannot be said with any truth to believe in what we call God; they believe indeed in spirits or ghosts, and it can be explained how such beliefs would be likely to arise.

Formerly I was led by feelings such as this just referred to (although I do not think that the religious sentiment was ever strongly developed in me) to the firm conviction of the existence of God and of the immortality of the soul. In my Journal I wrote that while standing in the midst of the grandeur of a Brazilian forest 'It is not possible to give an adequate idea of the higher feelings of wonder, admiration and devotion which fill and elevate the mind.' I well remember my conviction that there is more in man than the mere breath of his body. But now the grandest scenes would not cause any such convictions and feelings to rise in my mind. It may be truly said that I am like a

man who has been color blind, and the universal belief by men of the existence of redness makes my present loss of perception of not the least value as evidence. This argument would be a valid one if all men of all races had the same inward conviction of the existence of one God, but we know that this is very far from being the case. Therefore, I cannot see that such inward convictions and feelings are of any weight as evidence of what really exists. The state of mind which grand scenes formerly excited in me and which was intimately connected with the belief in God did not essentially differ from that which is often called that sense of sublimity, and however difficult it may be to explain the genesis of this sense, it can hardly be advanced as an argument for existence of God any more than the powerful though vague and similar feelings excited by music.

With respect to immortality nothing shows to me how strong and almost instinctive a belief it is as the consideration of the view now held by most physicists, namely that the sun with all the planets will in time grow too cold for life unless indeed some great body dashes into the sun and thus gives it fresh life.—Believing as I do that man in the distant future will be a far more perfect creature than he now is, it is an intolerable thought that he and all other sentient beings are doomed to complete annihilation after such long continued slow progress. To those who fully admit to the immortality of the human soul, the destruction of our world will not appear so dreadful.

Another source of conviction in the existence of God, connected with the reason and not with the feelings, impresses as having much more weight. This follows from the extreme difficulty or rather improbability of conceiving this immense and wonderful universe, including man with his capacity for looking far backward and far into futurity as the result of blind chance or necessity. While thus reflecting I feel compelled to look to a first cause having an intelligent mind in some degree analogous to that of man, and I deserve to be called a Theist.

Note added later:

(“This conclusion was strong in my mind about the time as far as I can remember, when I wrote the *Origin of Species*; and it is since that time that it has very gradually with many fluctuations become weaker.”)

But then arises the doubt, can the mind of man which, as I fully believe, has been developed from a mind as low as that possessed by the lowest animals, be trusted when it draws such grand conclusions? May not these be the result of the connection between cause and effect which strikes us as necessary one, but probably depends mainly on inherited experience? Nor must we overlook the possibility of the constant inculcation of a belief in God on the minds of children producing so strong and perhaps an inherited effect on their brains not as yet fully developed, that it would be as difficult for them to throw off their belief in God as for a monkey to throw off its instinctive fear and hatred of a snake. I cannot pretend to

throw the least light on such abstruse problems. The mystery of the beginning of all things is insoluble by us; and I for one must be content to remain an agnostic.

Nothing is more remarkable than the spread of skepticism or rationalism during the latter half of my life.¹¹

Development of Skepticism

It is apparent that once Darwin had given up his acceptance of the authority of the Scriptures and the historicity of their reports he moved farther and farther from the faith and more and more into the area of skepticism. The rational arguments for the existence of God which may indeed serve as support for the structure of the individual's faith collapse once the foundation of Scriptural authority has been removed.

In his own mind Darwin was able to explain those observations which others believed supported the concepts of the existence of God and of the immortality of the soul on the basis of natural selection and natural laws. Indeed he feels natural selection better explains the existence of evil and suffering than does Scripture.

Still he found at least one major problem—the complexity of the universe, as quoted previously. Although this view of an intelligent “first cause” gradually dimmed over the years.

Darwin also had problems with origins. He speaks of “The mystery of the beginning of all things” which he rates as “insoluble.” He recognizes the limitations of the human mind; he is willing to reduce the significance and validity of arguments for the existence of God because of this limitation but he is unwilling to apply it to his own speculations regarding the development of living things. Rather interesting in the light of our present attitude over against Lamarckianism is his acceptance of the inheritance of acquired characteristics when he suggests that the idea of God may be due to “inherited experience” as mentioned above.

What about religious belief and morality? Darwin deals with this question too. Having given up Scriptures and a morality based on its principles and motivated by the Gospel, he turns to a work righteousness and a justification by the good life he has lived. He writes:

A man who has no apparent and ever present belief in the existence of a personal God or of future existence with retribution and reward can have for his rule in life, as far as I can see, only to follow those impulses and instincts which are the strongest or which seem to him the best ones. A dog acts in this manner, but he does so blindly. A man, on the other hand, looks forward and backwards and compares his various feelings, desires and recollections. He then finds, in accordance with the verdict of all the wisest men, that the highest satisfaction is awarded from following certain impulses, mainly the social instincts. If he acts for the good of others he will secure the approbation of his fellow man and gain the love of those with whom he lives; and this latter gain undoubtedly is the highest pleasure on this earth. By degrees it will become intolerable to obey his sensuous passions rather than his higher impulses which when rendered habitual may be almost

called instincts. His reason may occasionally tell him to act in opposition to the opinion of others whose approbation he will then not secure, but he will still have the satisfaction of knowing that he has followed his innermost judge or conscience. As for myself I believe that I have acted rightly in steadily following and devoting my life to science. I feel no remorse for having committed any great sin, but have often and often regretted that I have not done more direct good to my fellow creatures. My sole and poor excuse is much ill health and my mental constitution which makes it extremely difficult for me to turn from one subject or occupation to another. I can imagine with high satisfaction giving up my whole time to philanthropy but not a portion of it though this would have been a far better line of conduct.¹²

Conclusion

Darwin's introspection and frankness are interesting. They show an evolution, a change from apparent orthodoxy to skepticism and agnosticism. He bares his soul to his children in the handwritten *Recollections*. No doubt some of the seeds of doubt were planted

during Darwin's childhood, but much of this development came about after he had abandoned his faith in the authority of the Biblical record. He had made the human mind his authority, and it led him from orthodoxy to theism to agnosticism. Indeed it appears he might well be characterized as an atheist, a doubter of the very existence of God. His caution, however, and his recognition of the impossibility from a scientific standpoint of proving a negative led him to characterize himself as an agnostic which he says he is content to remain.

References

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5. *Ibid.*, I, p. 45.
6. *Ibid.*, I, p. 40.
7. Darwin, Charles. *Op. cit.*, p. 62f.
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10. *Ibid.*, pp. 63f.
11. *Ibid.*, pp. 65-73.
12. *Ibid.*, pp. 73A-73B.

ICE AGES: THE MYSTERY SOLVED? PART III: PALEOMAGNETIC STRATIGRAPHY AND DATA MANIPULATION

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Abstract

This part completes the discussion of dating deep-sea cores by examining the new method of paleomagnetic stratigraphy. Too many unsolved problems exist to objectively date ocean sediments by magnetic reversals. Other possible mechanisms that may cause reversals in rocks or sediments are discussed. The dated oxygen isotope fluctuations are statistically analyzed for the controlling frequencies by power spectrum analysis. The predominant cycle matches the exceedingly weak eccentricity cycle in the Milankovitch theory. Even though this is claimed to prove the theory, it has caused even more serious problems. The question naturally arises of how order can be generated from the chaos of uncertainties and problems to produce their consistent results. It is shown that extreme bias in the astronomical theory has caused the manipulation of data by various means, and the "reinforcement syndrome" acts like a traffic policeman to keep data and researchers in order.

I) PALEOMAGNETIC STRATIGRAPHY

A) Introduction

Part I of this article showed how an uniformitarian ice age was practically impossible. However, many scientists now believe that the radiationally weak Milankovitch cycles have caused regular glacial/interglacial changes. The basis of this belief is the excellent statistical fit between dated oxygen isotope fluctuations of deep-sea cores and the three orbital variations. Part II examined this basis, showing that little really is known about the cause of oxygen isotope fluctuations. Before "absolute" dating methods are applied, cores are stratigraphically pigeon-holed into their geological context. Radiocarbon and the uranium series disequilibrium methods of dating are burdened with currently unsurmountable problems. This section continues with dating methods of ocean sediments.

The third main dating technique applied to Pleistocene deep-sea cores, as well as to other geological periods, is paleomagnetic stratigraphy, which is based on supposed reversals of the earth's magnetic field. Paleomagnetism has been primarily responsible for the revolution in the geological sciences caused by the plate tectonics theory.¹ It was not until the magnetic stripe pattern was discovered on the ocean bottom and related to changes in geomagnetic polarity as the ocean crust spread from certain centers that earth scientists accepted continental drift and plate tectonics. Like other new geological methods, it contradicted other more-or-less established geological beliefs until a compromise was reached. This occurred in the field of paleomagnetism when it was discovered that certain index fossils used to date the Miocene-Pliocene boundary at nine million years ago were dated at five million years ago by the new method.² Since paleomagnetism was considered more reliable, the Miocene-Pliocene boundary was changed to the new date, causing much

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