that dental and cranial specializations debar the dipnoans from such an ancestral position, but it has been rather generally believed that the dipnoans are allied to the actual tetrapod ancestors, the rhipidistian crossopterygians. However, in recent years a number of workers, interested in cranial differences and not concerned with "soft parts" or embryology, have tended to deny that there is any close relationship between lungfishes and crossopterygians. This is the position taken in symposium papers by Jarvik and Bertmar. However, Denison presents an important piece of evidence to the contrary in a description of the oldest known lungfish, *Uranolophus*, recently discovered in the early Devonian of Wyoming. This form shows remarkable resemblances to crossopterygians. In characters not related to feeding habits, Denison says, "We find so many that approach the Rhipidistia that a close ancestral relationship seems to be clearly indicated."

The work of Goodrich, Watson, and Gregory in the earlier decades of the century clearly demonstrated that the rhipidistian crossopterygians were the group from which land vertebrates arose. In 1942, however, Jarvik, while agreeing that the rhipidistians were the ancestral stock, claimed that tetrapods arose from them in diphyletic fashion. He claimed that one rhipidistian group gave rise to the urodeles, a second group to frogs and all higher tetrapods. Jarvik has continued to advocate this dual origin in a series of papers up to and including a discussion in the present volume. However, with increasing knowledge of crossopterygian structure in recent years, serious doubts have arisen regarding Jarvik's theory. Thomson, in a paper on rhipidistian–amphibian relationships, sums up much of the evidence and concludes that "there is no safe evidence for the view that the Rhipidistia are distinctly separated into two distant lineages or that any particular rhipidistian group is specially characterized by features indicating a unique relationship to any particular group of modern Amphibia."

Above I have discussed only a fraction of the papers contained in this volume—merely those dealing with certain of the more disputed areas in fish evolution. There are numerous other papers—to a total of 28—which are valuable contributions in less controversial fields. Notable, for example, are a reasoned discussion by Moss of the origin of vertebrate calcified tissues and a parallel survey of the dermal skeleton by Ørvig. Altogether, the Stockholm group is to be congratulated on producing, resultant from the symposium, an important volume which will act as a catalytic agent in stimulating research on early vertebrate history for many years to come.

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The Planetary System

Physics of Planets. V. I. MOROZ. Translated from the Russian edition (Moscow, 1967). National Aeronautics and Space Administration, Washington, D.C., 1969 (available as NASA TT F-515 from Clearinghouse for Federal Scientific and Technical Information, Springfield, Va.). vi + 416 pp., illus. Paper, $3.

An Introduction to Planetary Physics. The Terrestrial Planets. WILLIAM M. KAULA. Wiley, New York, 1968. xviii + 492 pp., illus. $14.95. Space Science Text Series.

Their titles suggest a similarity of content, but these books are instead complementary, for Moroz emphasizes the physics of planetary atmospheres and Kaula discusses mainly the solid bodies of the planets and planetary applications of celestial mechanics.

Moroz writes authoritatively on planetary atmospheres, and even in translation the style suggests a splendid original. The treatment of the material is clear, comprehensive, and uncompromising. However, *Physics of Planets* has suffered from the passage of the time needed for translation, for much has happened since the book was written (most references are earlier than 1966); for example, none of the recent planetary probes are mentioned. There are some minor criticisms of the present version. The translation appears not to have been submitted to any competent scientist for correction of terminology and contains some disconcertingly odd words. It is a pity that the binding is so poor; my review copy fell to pieces as soon as it was opened. But the text of Moroz's book offers an excellent critical summary of the available material on the analysis of planetary atmospheres up to the date of writing, and one may look forward to the revised edition, which I understand is being written.

Kaula's book begins with a summary of geochemistry, petrology, geology, gravity, and planetary magetism, and continues with orbit theory in two tightly written and very good chapters on the dynamics of the earth-moon system and of the solar system; the material of these chapters alone could well form the basis of a course on celestial mechanics. Observations of planetary surfaces and the geology of the moon and Mars follow. The final chapter presents a summary of the evidence and current theories of the origin and evolution of the planetary system.

The section on the moon stresses the impact theory of the origin of lunar craters, although the possibility of a volcanic origin is also treated. I question Kaula's statement (p. 328) that "no wrench or strike-slip faults have been found on the moon"; see, for example, plate 19 in G. Fielder's book *Lunar Geology*, which clearly shows relative horizontal displacement of corresponding segments of lunar features, beyond all argument. Other such examples can be readily found from modern lunar photographs. However, for the most part, Kaula's treatment is impartial and the facts are clearly stated. Generally speaking, the book is excellent. Perhaps too much has been attempted in 445 rather small pages, but it is clearly written and is timely because little else has been written for the student planetologist. A book of this sort has been much needed.

Both books have extensive references and subject indices; Kaula's also has an author index. The papers cited in Moroz are more easily available to the Western reader than might appear from the absence of the Western (often the original) publication data. The page references in the index are pages in the Russian edition, although this is not stated; however, the original numbering is given in the page margins.

In summary, these two books are excellent additions to the literature, though the unavoidable omission of the work of the last 2½ years on planetary atmospheres from *Physics of Planets* reduces its value and points once more to the rapid pace of the advance in our knowledge of the planetary system.

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