

PREFACE

About An Uninvited Guest

Not even mentioned by name on the front page, and appearing in translucence in the last chapters only, an invisible ghost has sneaked in, and her footprints are clearly visible throughout the whole book.

She has been everywhere in the solar system, but her footprints are difficult to find elsewhere: they have been almost completely erased from the record as surely as, on the beach, the next wave erases footprints in the wet sand. In particular, since the planets and their big satellites have been considerably differentiated from the primordial stuff, their complex early history has seen many footprints-erasing rollers and breakers.

But many of the minor bodies of the solar system which are the matter of this book, have not had such a complex history. Presumably, their mass was smaller than the minimum requested to trigger the Big differentiation. For them, the early waves were ripples only; therefore, we can trace her steps backwards on the wet sand, and try to find clues on what she was like and where she came from. Although none of us have ever seen her, we all have recognized her: she is the Primitive Solar Nebula; the big question mark that permeates this whole book is the Origin of the Solar System; but the emphasis in this book is not about theories and models: it is about footprints.

About the Contradictions Found in the Book

Some of the original ideas that go astray from the traditional paths have survived refereeing, even when their evidence was soft or dubious. In a field where not much is known, it was felt that contradictions should not be removed at any cost for the sake of polishing the paradigm of accepted knowledge. The graduate student will learn what scientific theories look like when in the making, and the careful reader will easily discover his own truth, in particular by reading the discussions that are often illuminating.

Acknowledgements

Although this seems to be the first complete book devoted to the subject matter, the interrelations of comets, asteroids and meteorites have been more or less suspected or discussed in the past by a number of astronomers. I could not do justice to all of them, but I want to mention at least Fred Whipple, who

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for forty years has had in mind most of the problems that will be discussed here. It is only proper that this book be dedicated to him. More recently, Tom Gehrels (1971) has devoted a large fraction of the book "Physical Studies of the Minor Planets" (NASA-SP-267) to the Origin of the Asteroids and their interrelations with Comets, Meteorites and Meteors; page 429 in the same book, Ed Anders (1971) had surveyed our specific subject matter in an 18 page chapter, with emphasis on meteorites.

At the Sydney 1973 General Assembly of the International Astronomical Union (I.A.U.) the growing importance of the physical study of these interrelations had become apparent enough for the Executive Committee of the Union to decide one of those very rare modifications in the mandate of one of its Commissions: IAU Commission 15, formerly devoted to "The Physical Study of Comets," became: "The Physical Study of Comets, Minor Planets and Meteorites." (Perhaps it is the proper place to remind here that, although the IAU prefers to use the wording "Minor Planets," "Asteroid" is used interchangeably with the same meaning in the astronomical literature).

As the new President of IAU Commission 15, I had proposed in 1973 that an International Meeting should be organized to discuss these interrelations, in particular in order to cement the links between the former and the new members of the Commission. Approved by the IAU, which allocated a small amount of money to be used for travel grants, the meeting was sponsored by three other IAU Commissions (Commission 16: Physical Study of Planets and Satellites; Commission 20: Positions and Motions of Minor Planets, Comets and Satellites; Commission 22: Meteors and Interplanetary Dust). A Scientific Organizing Committee was established with A. H. Delsemme, Chairman (USA), E. Anders (USA), T. Gehrels (USA), I. Halliday (Canada), L. Kresak (Czechoslovakia), B. J. Levin (USSR), B. A. Lindblad (Sweden), B. G. Marsden (USA), N. B. Richter (East Germany), and A. A. Yavnel' (USSR).

Since the 1976 General Assembly of the IAU was going to take place in Grenoble, France; in order to help the European and in particular the East-European scientists to attend and make it a true International Convention, our Colloquium took place in Lyon, France, the previous week (August 17-20), under the name: "IAU Colloquium No. 39: Relationships between Comets, Minor Planets and Meteorites." The staff of the Observatoire de Lyon served in the local Organizing Committee, with P. E. Proisy as Chairman; M. T. Martel, Vice-Chairman; P. Mianes, Secretary. The meeting, that took place downtown Lyon, in the University buildings on the bank of the Rhône river, was attended by about 150 persons; in particular, 127 participants came from 23 different countries. IAU Colloquium No. 39 was dedicated to Fred Whipple, by P. Swings, former President of the I. A. U. During four days, 108 different communications were heard and discussed, often lively and sometimes vehemently. The Chairmen of the eight scientific sessions were: E. Anders, F. Edmondson, T. Gehrels, I. Halliday, L. Kresak, B. Marsden, E. Roemer, and J. Wood. An informal session, with discussions going on, took place on Saturday, August 21, during our visit to the charming medieval city of Perouges and later in the day, at the Observatoire de Lyon, where the hospitality of our French hosts (and their rosé wine) will be remembered by many participants!

The present book is issued from this International Colloquium, although it is much more than its mere Proceedings. 103 papers submitted by the participants and 6 more, by people who did not attend were subject to refereeing. The primary referees were the members of the Executive Committee and the Session Chairmen, who submitted 1 to 3 names of secondary referees for each paper. The refereeing took most of the Fall 1976 and Winter 1977; only 74 contributions have been finally kept in this volume; many authors have brought their text up-to-date in the Winter or Spring 1977; some late modifications were made in early Summer 1977. Many valuable papers were turned down only because they were outside the

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scope of this book; some of these have been or will be published elsewhere by their authors. J. Rahe, Secretary of IAU Commission 15, shared with me the editing of the discussions that took place in Lyon. We kept only those that were useful to give the atmosphere of the meeting, and suppressed those that were no more justified after the manuscripts' revisions.

The Local Committee closed IAU Colloquium No. 39 with a profit, that has been used to support the publication of the book, together with grants from the National Science Foundation and The National Aeronautics and Space Administration. The publication costs have recently risen fast, and the book turned out to be 25% thicker than planned. In order to remain within our self-imposed budgetary limits, we saved \$6,000 on the total price by using typing instead of typesetting. We hope that readers won't be too disappointed by its appearance. Mrs. Sue Hickey did the typing; Mr. Tom Durnford who heads the Publications Office of The University of Toledo was very helpful for the printing; Mrs. Sandra Keil was the graphics specialist. Finally, in order to get the book published before the end of 1977, I took the painful decision not to send the final proofs to authors for proofreading. My wife, Delphine, has not only been helpful from the beginning as Assistant Editor, but she has proofread the whole book; she can only hope that authors won't be too frustrated by the results.

At different stages and in different ways, the agencies, organizations and individuals mentioned before, plus the one hundred and six contributors, and some of the referees who have preferred to remain anonymous, have all had their share in the collective effort of bringing about this book to completion. I want to thank all of them wholeheartedly.

Toledo, August 1977

A. H. Delsemme