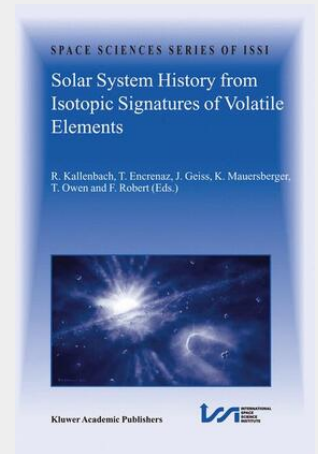


Solar System History from Isotopic Signatures of Volatile Elements

Volume Resulting from an ISSI Workshop 14-18 January 2002, Bern, Switzerland

This volume, number 16 in the Space Sciences Series of ISSI, reviews the present knowledge on many aspects of the history of the solar system. It focuses on isotopic signatures of volatile elements as tracers for the evolutionary processes during the formation of the Sun and the planets from an interstellar molecular cloud and, in turn, illuminates how the isotopic compositions of present-day solar system objects had been established. This integrated collection of articles complements the information provided by previous ISSI volumes such as *From Dust to Terrestrial Planets* and *Chronology and Evolution of Mars*, expanding the time scale for the history of the solar system. The convenors, Therese Encrenaz, Observatoire de Paris, Meudon; Johannes Geiss, ISSI, Bern; Reinald Kallenbach, ISSI, Bern; Konrad Mauersberger, Max Planck-Institut für Kernphysik, Heidelberg; Tobias Owen, University of Hawaii, Honolulu; and François Robert, CNRS-Museum d'Histoire Naturelle, Paris, invited experts in planetary science, solar and heliospheric physics, astrophysics, mineralogy, and chemistry to an interdisciplinary workshop in Bern, 14-18 January 2002. The resulting review articles are grouped into four sections 'Sun and Protosolar Nebula', 'Outer Solar System', 'Earth, Terrestrial Planets, and Moon', and 'Isotopic Fractionation Processes'.

This volume focuses on isotopic signatures of volatile elements as tracers for evolutionary processes during the formation of the Sun and the planets from an interstellar molecular cloud and, in turn, illuminates how the isotopic compositions of the present-day solar system objects have been established. The book is an integrated collection of articles by experts in planetary science, solar and plasma physics, astrophysics, mineralogy and chemistry that met for an interdisciplinary workshop at the International Space Science Institute in Bern in January 2002. The authors present analyses of isotope abundance ratios for volatile elements in the sun, planets, satellites, comets, meteorites and interplanetary dust particles, as well as a review of isotopic ratios in star-forming interstellar clouds. This provides insight into the physical and chemical processes in the pre-solar molecular cloud that collapsed to form the Sun and the solar accretion disk. Furthermore, information is presented on dynamical processes and conditions inside this protoplanetary disk, in particular the degree of reprocessing of interstellar solid material, the formation of solids inside the disks, and the formation of terrestrial and giant planets and their satellites. Isotopic fractionation processes discussed in this book include chemical reactions such as ion-molecule and photochemical reactions, nuclear processes inside the sun and in its atmosphere, plasma processes, gravitational escape of gases from planetary atmospheres exposed to the solar wind and solar radiation, thermodynamic processes, a variety of accretion and adsorption processes and mixing of material from the interstellar environment with the material of the evolving solar system. The volume is intended to provide active researchers in the fields of planetary science and space physics with an up-to-date status report on the topic, and also to serve graduate students with introductory material into the field.



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