

discovered only by operators drilling for structure or by random drilling. Many areas within the onshore United States are underexplored for these subtle type traps. With the availability of very high frequency/high-resolution data, these type plays can now be made.

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#### Geologic Exploration of Solar System

During the past quarter century, manned and unmanned spacecraft have explored seven planets, nearly three dozen moons, and one comet. In the process, astronomical objects have been transformed into unique worlds exhibiting a diversity of geological processes and materials. A new science of comparative planetology has developed, in which field experience on the Earth and the Moon aid in interpreting less well-known worlds. The processes that must have operated on the early Earth have been deduced from evidence from ancient surfaces of the Moon and planets. In particular, such comparative studies have demonstrated that only two geologic processes have been widespread throughout the history of the solar system: impact cratering and volcanism. Impact craters have formed throughout solar system history, indeed the planets themselves were formed by the accumulation of millions of smaller planetesimals, each of which formed an impact crater. Earth could not have escaped the intense bombardment that churned the surfaces of Mars, Mercury, and the Moon. The impact cratering rate dramatically declined about 3.9 billion years ago, but craters 10 km across still form on the Earth on the average of one every 140,000 years, and the 1.5-km wide Meteor Crater in Arizona formed only about 25,000 years ago.

Volcanic flows and cones have been observed on nearly all planets and moons in the solar system; the variety and duration of volcanism are directly related to planet mass. Thus, a relatively large planet like the Earth has a wide range of volcanic morphologies and compositions, with activity continuing throughout Earth history. In contrast, the smaller Moon produced a narrow compositional range of basaltic lava flows, with most of the lavas having erupted about 3 billion years ago. Water and sulfur volcanism have also been discovered on the cold satellites of the outer solar system, thus expanding our terrestrial concept of volcanism.

Many other processes and materials exist in the solar system, but the Earth remains unique in its richness of resources to support humans. Discovery and exploitation of extraterrestrial resources are beginning and must be greatly increased to prepare for our future as a space-faring race.

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