dren's socialization experiences and development," say Lytton, Conway and Suavé.

The Calgary results "give us strong reason to conclude that the socialization practices by parents which go with twinship are chiefly responsible for these effects," they say. □

Chemistry of still-green fossil leaves

Thirty million years ago some green leaves from elm trees in Oregon were rapidly buried under volcanic ash. Some of those leaves are still a vivid green today. Researchers at the New York Botanical Gardens are analyzing the chemical composition of the very well-preserved leaves to learn how flowering plants have evolved. So far they find the chemical profile of the prehistoric leaves surprisingly similar to that of modern leaves.

The Oregon leaves are not the oldest leaves that have been studied: Green leaves, at least 60 million years old, were reported previously in Germany. However, no one pursued the chemistry beyond identifying chlorophyll, the green pigment with which plants capture light. "Our work carried that much farther to the point of finding flavonoids, fatty acids, steroids and various other compounds," Karl J. Niklas explains to SCIENCE NEWS.

The biochemistry of plants may provide as much information about evolution as do the bones of dinosaurs. Plants, much more than animals, vary in the chemicals they contain. "Plants are very special as a group of organisms, they produce very, very high concentrations of diverse and, in many cases, diagnostic metabolites," Niklas says.

Niklas, working with David E. Giannasi, analyzed the chemistry of a dozen of the preserved leaves from three trees of the elm family. When they pulverized the leaves, extracted them in solvents and analyzed the extracts with sensitive chemical techniques, the investigators detected about 50 different compounds. Almost all of those chemicals are also present in leaves of the nearest living relatives to the prehistoric trees. The results for the tree *Zelkova oregoniana*, whose descendants are now native only to Asia, are published in the May 20 SCIENCE.

Niklas and Giannasi are particularly interested in the chemicals called flavonoids. Among modern plants, this class contains more than 600 members. The most complex flavonoids are found only in the evolutionarily advanced flowering plants, while the lower ferns and mosses have only simpler types, and algae have no flavonoids at all. Flavonoids seem to have numerous functions in the plants, such as attracting insects with bright colors, regulating growth, capturing light and protecting the plant with bitter tastes. Two flavonoids were detected in the preserved *Zelkova* leaves, one called kaempferol and the other a closely related compound. "This appears to be the oldest occurrence of flavonoids in fossil sediments reported," the researchers say.

Although the preserved leaves avoided most of the reactions that turn plants into coal, Niklas and Giannasi found some chemical changes had occurred. But the sediments containing the leaves seem not to have been covered by hot lava flows.

An amateur paleontologist, Bake Young, in 1968 first discovered the leaves Niklas and Giannasi are analyzing. This summer Young plans to lead the scientists to the site near Succor Creek to collect more specimens. Niklas and Giannasi hope to also find such well-preserved leaves in other locations. "We now have a handle on chemical evolution within flowering plants," Niklas says. "We may also get an idea of geographic points of origin." □

Pioneer 11: Looking good for Saturn

On Dec. 3, 1974, when Pioneer 11 became only the second spacecraft ever to approach the planet Jupiter, its mentors already had another goal in mind. Aided by the huge world's gravitational pull, the probe passed under the planet, whipped up the far side at more than 170,000 kilometers per hour and reemerged "over the shoulder" of Jupiter to head back across the solar system for a 1979 rendezvous with Saturn. It had not been designed for such a trek, but the attempt was felt to be worthwhile.

Last week, on June 10, Pioneer 11 reached Jupiter's orbit a second time, this time on the "Saturn-bound leg" of its journey. With nearly two-thirds of its flight time behind it, a check of the probe reveals that the afterthought mission is likely to become a successful reality.

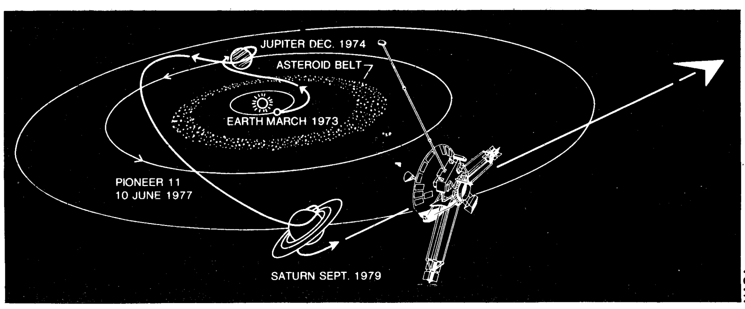
A key concern has been the amount of power that will be available by the time the craft reaches Saturn. Pioneer 11, like Pioneer 10 (which was not rerouted to Saturn), is powered by radioisotope thermoelectric generators (RTGS), whose electrical output diminishes with time. At launch, the RTG's were providing 166 watts of power, and engineers later predicted that 105 watts would be needed to do the job at Saturn. Believing that the devices would "degrade" at a constant rate, the engineers calculated that exactly 105 would be available—not a watt to spare. Instead, says project manager Charles Hall, the degradation rate seems to be slowing down year by year, so that 122 watts will be available at Saturn. There should also be 15 to 20 pounds of propellant left in the spacecraft's attitude-control system; the mission is expected to need only 6.

Only two of Pioneer 11's dozen scientific instruments have stopped working. An asteroid-meteoroid detector was turned off when its photocells grew too cloudy for use. A plasma analyzer for studying the solar wind and its interaction with planetary magnetic fields malfunctioned four months after the Jupiter encounter. Remaining, however, are the camera system (which doubles as a polarimeter and a zodiacal-light detector), two kinds of magnetometers, an infrared heat monitor, an ultraviolet photometer that can look for helium and for auroral effects, and a variety of charged-particle, cosmic-ray and radiation sensors.

There is also a device to count micrometeoroids, or space dust, which might seem useful in studying Saturn's rings, but it may have little to contribute in that role since it makes a measurement only once every 80 seconds. The spacecraft is expected to traverse the plane of the rings in less than half a second, so it would take extreme good fortune to produce a reading at just the right instant. The cameras are also unlikely to be able to "see" larger chunks, since the probe will be moving too rapidly by the time it is close enough to make them out. But there is a plan to seek variations in the light reflected from the rings as an indication of the particle size distribution. This fall, Hall says, the decision will be made whether to send the probe outside or inside the visible ring structure.

Meanwhile, the long trip from Jupiter to Saturn has been productive in its own right. The "slingshot" trajectory between the worlds has carried Pioneer 11 about 16° above the plane of the ecliptic (SN: 12/11/76, p. 373), making it the first spacecraft ever to provide earthlings with a look "down" on the solar system.

Date of the Saturn encounter: Sept. 1, 1979. □



Pioneer 11, first Saturn-bound spacecraft, owes the journey to Jupiter "slingshot."