a penetrator, coolant or radiator section and stem. The cone-shaped penetrator (made of a refractory metal) makes contact with the rock. Against its inside walls an electrical insulator is wrapped around the heating element. Another insulator separates the penetrator from the radiator section whose walls are cooled either by circulating water or by a gas such as argon or nitrogen (these gases will not corrode the subterrene's metal parts). Coolant and electrical feed lines are routed through the stem.

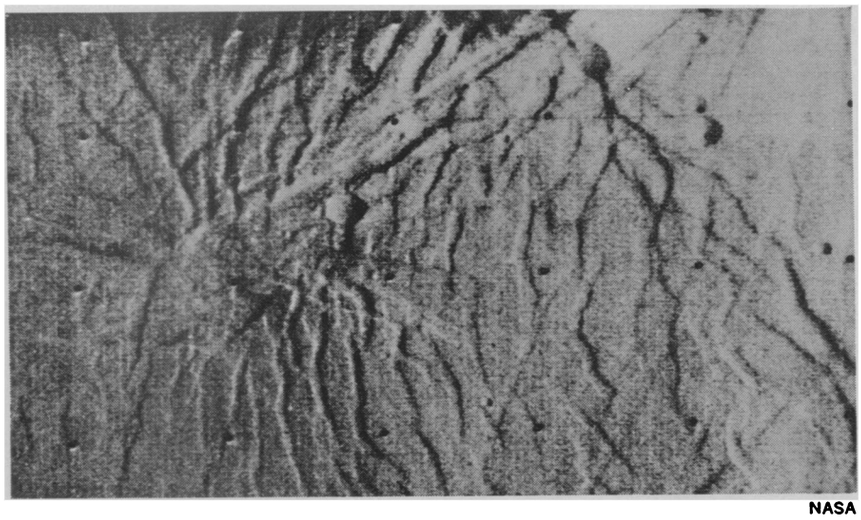
As the machine advances, molten rock is forced into voids in the walls of the hole and frozen in place by the cool surface of the radiator. This eliminates debris removal, one of the major problems in tunneling and deep-hole digging. The molten rock then forms an obsidian-like glass lining on the wall. This lining has a compressive strength at least 10 times that of concrete, say the engineers, and will provide support against cave-in.

The present 2-inch borer melts holes at a rate of 30 inches an hour, with a 3-kilowatt power supply—enough to light 30 100-watt bulbs. Rowley estimates that 10 to 50 megawatts will be needed to dig a 35-foot tunnel at the rate of 300 feet per day.

When this electric power supply is not available or when it is impractical Rawley suggests that atomic power will be used. A subterrene, with its own atomic reactor and with a wall grabber to propel it along the tunnel may eventually crawl through mountains or deep into the earth. The shape of the penetrator can be changed, to make a tunnel with a flat floor. The Department of Transportation has expressed interest. Or a circular penetrator might be used to take core samples from as deep as the earth's mantle.

The Los Alamos researchers predict that the subterrene will be used for the excavation of highway and railroad tunnels; subways; pipelines and channels for collection and transportation of wastes; conduits for fresh water, drainage and irrigation; wells for petroleum, natural gas and water; mine entries and ventilation ducts; underground silos for missiles and control systems; and for prospecting and exploring. □

Ripply landscape on Mars—believe it or not



NASA

Wrinkled Martian terrain may be a lava flow segmented by a network of faults.

The dust storm that has obscured much of the surface of Mars since late September has been gradually clearing. On Dec. 17, on its 67th orbit around the planet, Mariner 9 was able to photograph a bizarre landscape that, three weeks previously, had been hidden.

The photo, unlike any yet obtained, was released last week. It shows an area just south of the Martian equator that is criss-crossed by faults a mile and a half wide. Relatively few craters mar the surface, indicating that it is relatively young and may be covered by volcanic deposits that subsequently became faulted. The area photographed, known as Phoenicis Lacus, lies on a plateau about three-and-a-half miles above Mars' mean elevation; many lower areas are still hidden by dust.

The persistence of the dust storm and unforeseen effects of Martian gravity have necessitated a change in Mariner's orbit. On Dec. 30 the low point in the orbit was raised from 862 miles to 1,028 miles. The change will increase the area covered in photographs, allowing mapping to be completed in two 20-day cycles that began Jan. 2 and will free the 210-foot antenna at Goldstone, Calif., for use on the upcoming Apollo 16 mission. □

Correcting infertility without multiple births

Artificially inducing ovulation in women whose eggs generally do not mature has been possible for several years now. Treatment often consists of a preliminary injection of FSH (follicle stimulating hormone, which gets the ovaries ready for release of an egg), followed by an injection of LH (luteinizing hormone, which causes an egg to release). Sometimes a synthetic chemical, clomiphene, is used instead of FSH and LH to induce ovulation. But with all these injections, there is considerable risk of triggering the release of up to five, eight, even ten eggs at a time. Often the eggs are fertilized and the result has frequently been multiple births. The multiple pregnancy risk probably results from direct hormonal stimulation of the ovaries.

Now Arthur Zarate of the Mexico Institute of Social Security in Mexico City and Abba Kastin and Andrew Schally of the Endocrine and Polypeptide Labs at the Veterans Administration Hospital in New Orleans have tried inducing ovulation in infertile women in a less direct way. They have used injections of luteinizing hormone-releasing factor (LH/RH).

LH/RH was recently sequenced and synthesized by Schally's and Kastin's endocrine team at the VA Hospital (SN: 7/17/71, p. 37). It is a hypothalamus chemical, and a sort of master releasing factor for luteinizing hormone (the latter is made in the pituitary). For this reason the investigators were confident that they could induce ovulation with LH/RH. Because LH/RH acts indirectly on the ovaries, through LH, and not directly on them, they thought LH/RH might also possibly assure the release of only one egg at a time.

On this assumption they induced egg production in one woman with an injection of FSH, followed by an injection of natural LH/RH. The woman ovulated, and conceived one healthy baby. They then induced single ovulation in two other women by giving each two injections of synthetic LH/RH, 10 days apart. In this case no FSH was used beforehand.

LH/RH might be superior to present methods of infertility correction for several reasons, the investigators believe. It might cut down on the risk of large multiple egg release. It might be cheaper because it is synthetically available. FSH and LH are not. LH/RH is also natural to the body—not true of the drug clomiphene. But as Kastin says, "What makes LH/RH exciting for me is that it opens doors for investigating a whole new area of control of fertility and infertility." □