X-rays coming down the channel

Electrically charged bodies undergoing changes in speed or direction should emit electromagnetic radiation. This prediction of James Clerk Maxwell was revolutionary in its day (1876). By now it has become the basis of technologies ranging from the wireless telegraphy of Guglielmo Marconi to the very modern synchrotron radiation that is beginning to be used as a probe of the physics, chemistry and biology of small structures. From the first radio engineers to the operators of synchrotron radiation laboratories, it has been clear that periodic motions of the emitting particles provide the most manageable and best-directed beams of radiation. That characteristic is again exemplified in the newly demonstrated method of generating electromagnetic radiation called channeling radiation.

Lawrence Livermore Laboratory

Berman and Alguard admire the perfect silicon crystal in which positrons generated channeling radiation.

The channels in its title are routes through the array of atoms in a crystal. In a perfect crystal the atoms are arranged in a series of planes, and a particle with a path aligned parallel to those planes can pass through the crystal without hitting an atom, just as a person running through an orchard can avoid the trees by staying parallel to the rows. If such a particle is electrically charged, it will experience forces from atoms on all sides as it passes down the channel. These forces are periodic; the arrangement of atoms produces the effect of a series of smooth bumps in the stream, and the motion of the channeling particles is affected in a periodic way.

These facts led to a prediction put forth independently by two groups of Russian physicists and by Richard H. Pantell and Robert Terhune of Stanford University that particles moving at relativistic speeds through such channels should emit electromagnetic radiation. Because of the channeling and the periodic nature of the forces in the channel the radiation should have a very narrow waveband (close to a single wavelength) and it should be directed mostly in the particles' forward direction. The first experimental demonstration of channeling radiation was done by M. J. Alguard, R. L. Swent and Pantell of Stanford, B. L. Berman and S. D. Bloom of the Lawrence Livermore Laboratory and Sheldon Datz of Oak Ridge National Laboratory.

They used the Electron-Positron Linear Accelerator at Livermore to supply energetic positrons and a perfect single crystal of silicon to do the channeling. Getting the single crystal perfect and setting it up so that the positrons will channel — it is not easy to aim them that precisely — is a delicate and exacting procedure, but the group was successful in observing radiation peaks in the energy range between 30 and 50 kilo-electron-volts. In the April 23 PHYSICAL REVIEW LETTERS they conclude that the peaks they saw correspond well to those that theory predicts should come from channeling of positrons with 56 million electron-volts energy along the planes in a silicon crystal that crystallographers designate (110), (111) and (100). The result was also reported in a talk given by Pantell at the recent Washington meeting of the American Physical Society.

The energy range quoted for the emitted radiation is in the X-rays, and should arouse the interest of scientists interested in the study of structures that might be illuminated by them, although exactly how remains to be seen as those scientists become aware of the technique. The wavelength emitted depends on the energy of the positrons and the channel used. Using different positron energies, different channels in the same crystal or substituting different crystals can give it a wide versatility in providing desired wavelengths. □

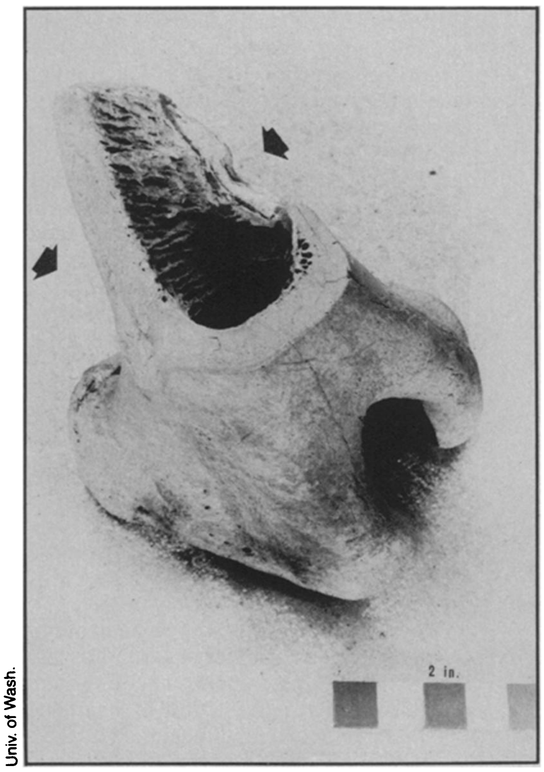
'Golden' discovery: Oldest Bering man?

In a discovery that she rates "an archaeologist's gold mine," University of Washington geologist Lee Porter has found fossilized animal bones in the Alaskan Yukon-Tanana uplands that have been radiocarbon dated to 29,700 years. Further examination of the bones has revealed chop marks, burn marks and spiral fractures indicating they were slaughtered by *Homo sapiens.*

Although there is evidence for the presence of humans in North America as far back as 40,000 years ago (SN: 3/26/77, p. 196), this discovery, found at the bottom of a 30-foot gold mine, marks the earliest known presence of humans in a Bering Land Bridge site. In addition, the bones, which include those of extinct lions, bison, musk oxen, "little wild horses" and wooly mammoths, are securely carbon dated, something Porter says is difficult to do in many sites because of the presence of calcium carbonate, a contaminant of radioactive carbon.

The presence of the bones supports the theory that early humans migrated to Alaska from Siberia in search of game during the Pleistocene Era (a period lasting from 1.8 million to 10,000 years ago). The interior of Alaska seems to have escaped the massive accumulation of ice that occurred elsewhere because it was protected by mountain ranges on the north and south, becoming a wildlife refuge and sanctuary.

Examination of some of the bison bones by the University of Maine's Robson Bonnichsen seems to indicate that the animals were butchered by early humans who, lacking usable rocks and the technology to craft metal tools, used bone fragments broken from the animals themselves to loosen and carve the meat.



Univ. of Wash.

Limb bone of bison taken from Alaskan site shows evidence of human slaughter: Arrow at right indicates impact point, that on the left a butchered fracture.

Porter, who pre-selected the area in advance of her discovery, says that "it may be possible within the next 10 years to uncover fossils of early man which date back as far as 60,000 years ago."

A sample of Porter's findings will be displayed at the University of Washington and will later be shipped to the Smithsonian Institution. □

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