current interaction, that is, it preserved the electric charges of the particles that went into it. Currents proved a good way of looking at the weak interaction too, but it became very clear that here one was dealing with a charged current interaction: In weak-interaction collisions the particles always exchanged a unit of charge, uncharged ones becoming charged and charged ones neutral. It seemed a fundamental dissimilarity between electromagnetism and the weak interaction.

But now neutral weak currents have been found. This provides an analogue and a similarity between the two kinds of interaction. Of course there was a theoretical development that anticipated the experiments and undoubtedly gave experimenters an idea of something to look for. But the phenomenon is there in nature and would have been found sooner or later, theory or not. Either theory or experiment is a significant achievement. The concatenation calls for imported rather than domestic champagne.

Now let's look for another similarity. The latest news is that the NAL group reports that it is finding a new similarity thanks to its ability to experiment at very high energies. NAL is the most energetic particle accelerator in the world, and it was designed with facilities for producing copious beams of high-energy neutrinos, a probe particle essential for studying the weak interaction. Cline compares studying the weak interaction with beta decay to the work of 18-century natural philosophers who studied static electricity. The connection between electricity and magnetism became apparent in the early 19th century when Hans Christian Oersted was able to experiment with currents in wires. Likewise, Cline expects, and he is not alone, the similarities between electromagnetism and the weak interaction should become more visible at NAL energies. Indeed they do. At least one more does. It has to do with the relative strengths of the two forces.

The four forces of physics do not all have the same intrinsic strength. From weakest to strongest they go: gravity, weak, electromagnetism, strong. Why the differences exist is one of the standing mysteries of physics, and philosophers of science make whole books out of the meanings of the numbers. The extreme-strength ratio, of strong force to gravity, is something like 10^{40}.

In low-energy processes like beta decay the strength of the weak force is about one ten-billionth that of electromagnetic forces in the same nuclei. If the forces are to be similar and eventually united, such a wide discrepancy seems a bad omen. Well, the good news from NAL is that as the energy of the proceedings goes up, so does the strength of the weak force. The NAL physicists expect that at higher energies than those now available at NAL, the weak force may even become stronger than the electromagnetic.

"With these observations," says Cline, two important differences between weak and electromagnetic interactions are removed, and it appears more plausible that these interactions may somehow have a common origin." So we have here a lovely case in a matter of seminal importance for particle physics of theoretical and phenomenological courses that seem to be setting in the same direction. "It is possible," Cline goes on "that the study of weak and electromagnetic interactions is now entering the analogous phase of Oersted and Faraday [the other great 19th-century electromagnetic experimenter] in electromagnetism. Hopefully it will not take 42 years for a modern Maxwell to clarify the situation." □

Decoding the language of ancient Lycia

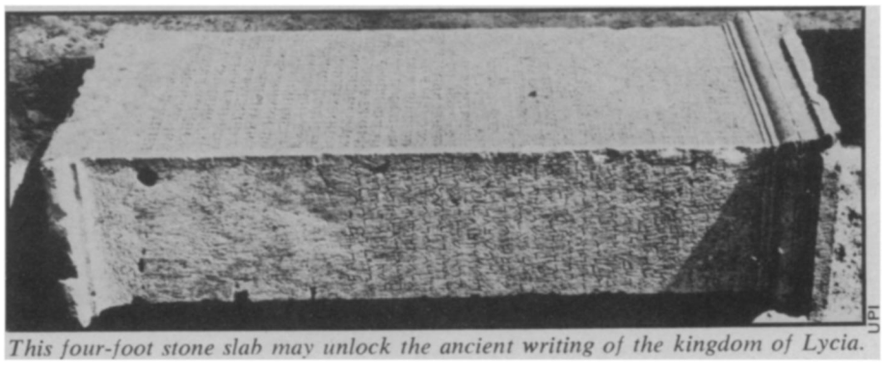
The Rosetta Stone, unearthed in 1799 near the Egyptian town of Rashid, or Rosetta, became perhaps the most famous archaeological discovery of all time when the two languages and three scripts of its inscriptions enabled Thomas Young and Jean Francois Champollion to crack the key to ancient Egyptian hieroglyphics. Now another multilingual slab is promising to open the door to another early written language: Lycian.

Lycia was a sea-faring kingdom occupying the rugged mountains and Mediterranean coastal region of what is now southern Turkey, several centuries before Christ. Most of the little that is known of the kingdom comes from excavations at the site of its capital city, Xanthos, but this is largely in the areas of art and architecture, with relatively few examples of writing. Some bilingual samples—in Lycian and ancient Greek—have been discovered, but most of these are simple tomb inscriptions with too few words and too little grammar to really "break the code."

At last, however, the key to the code may have been found. Last summer, a team of archaeologists headed by Henri Metzger of Lyon University in France discovered in southern Turkey a four-foot-high stone slab inscribed in not two languages, but three—Lycian, Aramaic and Greek. (Aramaic, besides being the language of Christ, was the official language of the Persian empire and the *lingua franca* of much of the ancient Near East.) The inscription on the stone, as deciphered from its better-known languages, is believed to concern the establishment of two new gods by a local governor named Pixodaros. Metzger dates the stone at 358 B.C., the beginning of the reign of Artaxerxes III over the Persian empire.

By comparing the Lycian account with the better-understood Greek and Aramaic versions, researchers hope to fill in the gaps in their knowledge of Lycian writing, part of whose alphabet is still not understood. The slab itself is in superb condition, Metzger says, and its inscriptions are deep and clear, but the task of decipherment is still not an easy one. One obstacle, warns Near East historian James Muhly of the University of Pennsylvania, could be that the inscriptions in the three languages are not identical. Often in multilingual tablets, he says, one language will carry the complete text while the others are only paraphrases. On the new slab, he adds, "I have heard that the Lycian text is much shorter."

This would not be completely unexpected, say Muhly, since by the date Metzger assigned to the slab Lycian was probably already an archaic language. Translators will have to try to make up for the lack of one-to-one correspondence by comparing the overall meanings in the different languages, even with their limited knowledge of Lycian. Difficult though the work will be, says Metzger, the slab "should allow us to make substantial headway in understanding more about the Lycian tongue." □



This four-foot stone slab may unlock the ancient writing of the kingdom of Lycia.