fault plane. The fault zone extends for a distance of approximately 14 miles, from a point a mile or more to the northwest of Helena to an indefinite point between East Helena and Clasoil. The fault is probably of the normal type, and is part of the late Tertiary diastrophism. The zone of slipping is near the northern border of the Boulder Batholith.

According to the Rossi-Forel scale the intensity of the three more important shocks was determined as 8, 9 and 9 minus, respectively. The greatest damage occurred on October 18 at 9:47 P. M. This shock was felt over an area of about 200,000 square miles. At that time two lives were lost and property damage was estimated at about $3,000,000 in Helena and East Helena. Few buildings were completely destroyed, but many partially ruined. Many structures were so severely weakened by the shocks on October 12 and 18 that the shock on the 31st caused numerous buildings to collapse.

The after-shocks are still in progress and some are of great enough intensity to be felt 75 miles distant. The stronger after-shocks are severe enough to cause loose plaster and bricks to fall. To date more than 900 minor shocks have been recorded by W. E. Maughan, Federal Metrologist, at the Helena Weather Bureau.

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ON THE HISTORY OF NEGATIVE NUMBERS

THE history of the negative numbers has recently been extended backwards more than a thousand years by the discovery of the fact that the ancient Babylonians used such numbers occasionally in their statements relating to algebraic equations. It has commonly been assumed that the ancient Hindus were the first to employ actually negative numbers but that the ancient Greeks operated somewhat earlier with binomials of the form $a-b$, where a and b are positive numbers and $a > b$. In this connection Diophantus, in the second half of the third century A.D., stated that a subtracted number multiplied by a subtracted number gives an added number and that a subtracted number multiplied by an added number gives a subtracted number. These "rules" were later observed to apply to actually negative numbers as well as to subtracted numbers when the minuend is larger than the subtrahend, as was always assumed by Diophantus and by the other Greek writers.

Recently O. Neugebaur, who was formerly at Göttingen, Germany, but is now at Copenhagen, Denmark, published a volume in two parts under the title "Mathematische Keilschrift-Texte," which appeared as volume 3, Abteilung A, of the well-known periodical entitled *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik,* which was started in 1930 and appears irregularly. On page 387 of the first part of this volume he calls attention to the fact that the second member of the ancient Babylonian equations was sometimes a negative number while at other times it was either positive or zero. On page 463 he gives an example of an equation of the former type and emphasizes the fact that it follows from the language that the writer was fully aware that he was dealing with a negative number as a second member of this equation.

The use of a negative number alone as a member of an equation is a noteworthy fact in the history of negative numbers but it should be emphasized that it does not imply that the ancient Babylonians understood negative numbers in the modern sense of this term. Such an insight does not seem to have been attained before about the beginning of the nineteenth century. In very ancient times the Babylonians had a special symbol, called lal, which corresponds to our minus sign, so that a lal b corresponds to our $a-b$, where a and b are positive and a exceeds b, but there is a considerable step from this use to the use of a negative number standing alone as a member of an equation. It is this step which is emphasized here, but beyond this there is a much longer step leading to the establishment of the legitimate use of negative numbers in the various elementary operations. The latter step presented the greatest difficulties and does not seem to have been undertaken by either the ancient or the medieval mathematicians.

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SYNCHRONOUS FLASHING OF FIREFLIES

IN a recent discussion of the synchronous flashing of fireflies, John Bonner Buck,[1] of the Zoological Laboratory of the Johns Hopkins University, contributes experimental evidence directly bearing on certain phases of this behavior as observed for some American fireflies.

In addition to the references mentioned by Buck, I have come across additional ones. Konrad Guenther[2] in 1931 says:

> In Petropolis, on New Year's Eve, as I walked through the gardens in a fragrant summer night, the lawns were as though illuminated, and with astonishment I noted how hundreds of green lights blazed out simultaneously and were simultaneously extinguished, with so regular a rhythm that it seemed as though the sparks were blown rapidly by a huge mechanical bellows that gave a puff every second. Of this extraordinary phenomenon I could give no explanation.

[1] SCIENCE, 81: 339–340, April 5, 1935.

[2] "A Naturalist in Brazil." (Translated from German by Bernard Miall), pp. 227–228. Houghton Mifflin Company, 1931.