sufficiently conversant with the Latin names of plants to know that *Origanum* was the generic name of a plant whose popular name is marjoram? The Encyclopaedia Britannica says: "The name [Oregon], like the whole story [of Carver] may have been of Spanish or Indian origin, or it may have been purely fanciful. . . . There have been many ingenious but quite unsatisfactory efforts to explain the derivation of the word *Oregon*." That it refers, even indirectly, to a plant seems to me extremely remote.

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THE INFLUENCE OF THE INSTARS OF HOST LARVAE ON THE SEX OF THE PROGENY OF TIPHIA POPILLIAVORA ROH.

STUDIES recently completed on the interrelation between the larval instars of the Japanese beetle (*Popillia japonica* Newm.) and its parasite, *Tiphia popilliavora* Roh., revealed that the female parasite has the ability to control the sex of her progeny at the time of host parasitization. The stimulus to which the female responds in controlling the sex of her progeny is definitely associated with the instar or size of host on which the eggs are placed.

There are three instars in the larval development of the Japanese beetle. Each instar is characterized by an average larval size which varies considerably from the average size of the larvae in the other two instars. The second-instar and third-instar larvae are accepted by the parasite for parasitization and development goes to completion on both of these hosts. The female parasite shows a decided preference for third-instar host larvae for parasitization; however, in the absence of third-instar host larvae, second-instar host larvae are readily accepted for parasitization. In a number of observations in which fertile female parasites were furnished both second-instar and third-instar host larvae simultaneously, second-instar or third-instar host larvae exclusively and second-instar and third-instar host larvae on alternate days, the resultant parasite progeny were predominantly males from the parasitized second-instar host larvae, while a normal sex ratio consisting of slightly more female than male parasites resulted from the parasitization of third-instar host larvae.

Definite proof that the female parasite has the ability to vary the sex of her progeny at the time of parasitization of the host larvae of different instars was obtained when parasite eggs placed by fertile females on second-instar host larvae were transferred to third-instar host larvae and eggs placed on third-instar host larvae were transferred to second-instar host larvae. The resultant parasite progeny were still predominantly males when parasite eggs were transferred from second-instar host larvae to the larger third-instar host larvae, while a normal ratio of males and females resulted when parasite eggs were transferred from third-instar host larvae to the smaller second-instar host larvae.

A detailed discussion of the data obtained in these studies is now in the course of preparation and will appear in entomological literature at some later date.

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THE ACTION OF P-AMINOPHENOL ON TISSUE OXIDATIONS

P-AMINOPHENOL in a concentration of M/5,000 inhibits the oxygen uptake of rat liver suspensions 50 per cent. This inhibition is constant over a period of three hours after which it begins to wear off. The inhibition manifests itself only in acid solutions such as pH 6.4 and 6.7. At pH 7.8 there is practically no effect. If larger concentrations of p-aminophenol are used the inhibition is masked by the oxidation of the substance to the quinone, which may then be reduced by the tissue and reoxidized. But in low concentrations this effect, if it does take place, is unimportant compared to the marked inhibition of the oxygen uptake. Aniline and phenol itself in two to four times the concentration produce under the same conditions inhibitions of only 5 to 20 per cent. Salicylic acid and acetanilide are also relatively ineffective. Other substituted phenols are also being tested and experiments are being done to determine what oxidizing systems are inhibited. It might be pointed out that under the same conditions it requires a concentration of M/500 cyanide to give the same percentage inhibition.

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A LARGE CATCH OF NOCTILUCA

THE large, spheroidal dinoflagellate, *Noctiluca scintillans* (Macartney) Kofoid and Swezy, has considerable general interest because it was one of the first organisms to be connected with the phenomenon of "phosphorescence" (luminescence) of sea water. Typical individuals (some reaching a diameter of one millimeter) are easily visible without magnification, and this fact may have been mainly responsible for the notice attracted by these organisms.

Apparently, the different writers commenting on prominence of *Noctiluca* have given no records of actual numbers found in a unit volume of water. On this account it may be worth noting that a density of more than three million individuals to a liter of water was found near Angel de la Guardia Island in the northern part of the Gulf of California on March 20, 1937.

The collections were made by Mr. Bruce M. Crawford, a member of the G. Allan Hancock Expedition to the Gulf of California in 1937. No filtration or condensation of the large catch was made. It was simply dipped from the surface of the gulf and preserved without change of volume. It was included in a series of catches of phytoplankton given to me for study.

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SPECIAL ARTICLES

RADIOACTIVITY OF POTASSIUM AND GEOLOGICAL TIME

HOLMES and Lawson,[1] in considering the effect of the radioactive elements on the age of the earth, have discussed the possible effects of uranium, thorium, potassium and rubidium. In their treatment of potassium and rubidium they considered all the isotopes to be radioactive, although they mentioned that their calculations would be materially different were this radioactivity confined to certain rare isotopes.

Potassium is known[2] to emit two hard β rays of velocity 0.83 c and 0.93 c in proportions 60 to 28. Holmes and Lawson assumed 0.85 c as a fair average in estimating λ, the disintegration constant. By considering all the isotopes to be equally radioactive they computed $\lambda = 4.6 \times 10^{-13}$ year^{-1} and the half life $T = 1.5 \times 10^{12}$ years. Hevesy[3] assigned the radioactivity to K^{41} and by assuming $K^{39}/K^{41} = 20$ for the abundance ratio estimated $T = 7.5 \times 10^{10}$. This value has also been accepted by Rutherford, Chadwick and Ellis.[4] Various other estimates presented in the literature are close to this value.

The radioactivity of potassium has recently been shown by Smythe and Hemmendinger[5] to be confined largely to K^{40}. The abundance ratios for the various isotopes of potassium have been measured with considerable accuracy; these ratios have been determined for shales and for commercial potassium salts. The values are $K^{39}/K^{41} = 14.20 \pm 0.02$ and $K^{39}/K^{40} = 8300 \pm 100$; this gives $K^{39} + K^{40} + K^{41}/K^{40} = 9000$.[6] The half life and disintegration constant must now be changed accordingly, the corrected values becoming $\lambda = 4.13 \times 10^{-9}$ year^{-1} and $T = 1.67 \times 10^{8}$ years. The new constants materially change the conclusion of Holmes and Lawson that in early Archaean rocks (age 10^9 years) the heat evolved in the dissociation of potassium was but one per cent. more than at present.

The ratio of the amount of K^{40} present at various geological ages compared with that in existence to-day is given in Table 1. These values are computed from the equation $N^t/N^o = e^{-\lambda t}$ where N^t, the concentration of K^{40} at the present time, is taken as unity.

TABLE 1

tYears	K^{40}	U	Th
10^6	1.0042		
10^7	1.0418		
10^8	1.511		
3×10^8	3.452		
10^9	62.18	1.162	1.0053
1.43×10^9	360.0		
3×10^9	2.4×10^5		
10^{10}	9.65×10^{17}		

The amounts of uranium and thorium are included at 10^9 years for comparison; the calculations are based on the values 1.5×10^{-11} years^{-1} and 5.33×10^{-12} years $^{-1}$ respectively for the disintegration constants.

The values given above may now be used to calculate an approximate upper limit for the age of the earth and for the time of congealing of the earth's crust. Obviously the earth could not be 10^{10} years old, for if it were it would have been composed almost entirely of K^{40}. Since K^{40} disintegrates into Ca^{40}, an upper limit for the age of the earth must be set by the amount of Ca^{40} in existence at the present time. The relative concentrations of Ca^{40} and K^{40} in the earth's crust are $Ca^{40}/K^{40} = 1.4 \times 10^4$. The upper limit for the age of the earth is, in consequence, slightly less than 3×10^9 years.

A tentative date for the congealing of the earth's crust may be obtained by assuming that radioactivity is a controlling factor in maintaining the internal temperature of the earth. At a surface temperature of 1,000° C., a fair value for fusion of the earth's crust, the heat lost by radiation under black body conditions will be 360 times that lost at present. A supply of this amount of heat must be added to compensate the loss through radiation. At the present time the amount of radioactive energy liberated by potassium, uranium and thorium is of the same order of magnitude; at 10^9 years, however, it will be seen from the table that the energy liberated from K^{40} is far in excess of that from uranium and thorium. K^{40} alone at 1.4×10^9 years is capable of supplying the entire additional loss of energy through radiation. This is almost identical to the date of congealing of the earth's crust as estimated from the uranium-lead ratio.

The relative abundance of K^{40} at 3×10^8 years is included in the table, since this is the probable date of the carboniferous era. There is considerable evidence indicating that the pronounced effect of potas-

[1] A. Holmes and R. W. Lawson, *Phil. Mag.*, 2: 1218, 1926.

[2] D. Bocciarelli, *Atti, accad. Lincei*, 17: 830–33, 1933.

[3] G. Hevesy, *Nature*, 120: 838, 1927.

[4] Sir Ernest Rutherford, J. Chadwick and C. D. Ellis, "Radiations from Radioactive Substances," Cambridge, 1930.

[5] W. R. Smythe and A. Hemmendinger, *Phys. Rev.*, 51: 178, 1936.

[6] A. Keith Brewer, *Phys. Rev.*, 48: 640, 1935. A. Keith Brewer, *Jour. Am. Chem. Soc.*, 58: 370, 1936. A. O. Nier, *Phys. Rev.*, 48: 283, 1935.