ist deshalb möglich, das $^{87}Sr/^{86}Sr$-Verhältnis dieses Meteorits demjenigen gleichzusetzen, das man von einem Ur-Strontium erwartet[3]. Das Resultat bei *Bu* (Achondrit) bestätigt das Vorkommen so niedriger $^{87}Sr/^{86}Sr$-Verhältnisse, die in irdischem Material bis jetzt nicht gefunden worden sind[4].

Subtrahiert man unter dieser Voraussetzung die $^{87}Sr/^{86}Sr$-Werte der drei Achondritmessungen von demjenigen des *FC* (Chondrit), so wird der radiogene Anteil des Strontiums $^{87}Sr(rad.)/^{86}Sr$ erhalten. Durch Multiplikation mit dem chemischen Faktor wird die letzte Spalte bestimmt.

Meteorit	$^{87}Sr/^{86}Sr$	$^{86}Sr/^{87}Rb$	$^{87}Sr(rad)/^{87}Rb$ in *FC*
FC	0,7480 ± 0,006	1,04 ± 0,03	–
Pa 0	0,6853 ± 0,004	64,8 ± 1,4	$0{,}065_2$ ± 0,007
Pa 1	0,6822 ± 0,007	46,5 ± 1,3	$0{,}068_3$ ± 0,009
Bu	0,6816 ± 0,004		$0{,}069_0$ ± 0,007
		Mittelwert	$0{,}067_5$ ± 0,008

Diese Resultate erlauben, unter den in [1] diskutierten Modellvorstellungen das Alter von *FC* zu ermitteln, wenn die Halbwertszeit von ^{87}Rb bekannt ist. Eine inzwischen erschienene Arbeit von ALDRICH *et al.*[5] ergibt aus der Korrelation konkordanter U-Pb-Alter von Uranmineralien mit dem $^{87}Sr(rad.)/^{87}Rb$ kogenetischer Glimmer ein $T_{1/2} = 5{,}0 \cdot 10^{10}$ a, das zwischen den heute vorliegenden Werten aus der Ermittlung der spezifischen Aktivität von ^{87}Rb liegt[6].

Für *FC* hat PATTERSON $^{206}Pb/^{207}Pb$-Altersbestimmungen ausgeführt[7], womit der *FC*-Messpunkt im Diagramm ergänzt werden kann. Dieser liegt innerhalb der Fehlergrenzen auf der Korrelationsgeraden der Messwerte irdischer Proben. Man findet dabei für das Rb-Sr-Alter von *FC* einen Wert von 4,5 ± 0,4 Milliarden Jahren. Der frühere Schluss[1] kann also bestätigt werden, dass der radioaktive Zerfall von ^{238}U, ^{235}U, ^{87}Rb und ^{40}K innerhalb der Fehlergrenzen der Messungen ein übereinstimmendes Alter für den Chondrit Forest City liefert.

Hiermit ist ein unterer Grenzwert für das Alter des Universums experimentell gut gestützt. Ausserdem erhalten die Modelle der Auswertung der drei Altersbestimmungen einen hohen Grad von Wahrscheinlichkeit.

Ich danke Herrn Prof. F. G. HOUTERMANS, Bern, für anregende Diskussionen.

E. SCHUMACHER

Chemisches Institut der Universität Zürich, den 5. November 1956.

[3] Ur-Strontium ist Sr, das seit der «Entstehung der Elemente» nie längere Zeit mit ^{87}Rb in Berührung war; vgl. Ur-Blei aus dem Canyon-Diablo-Meteorit, zum Beispiel F. G. HOUTERMANS, Nuovo Cimento *10*, 1623 (1953).

[4] L. F. HERZOG, Progress Report 1955/56, Geological Dep. MIT.

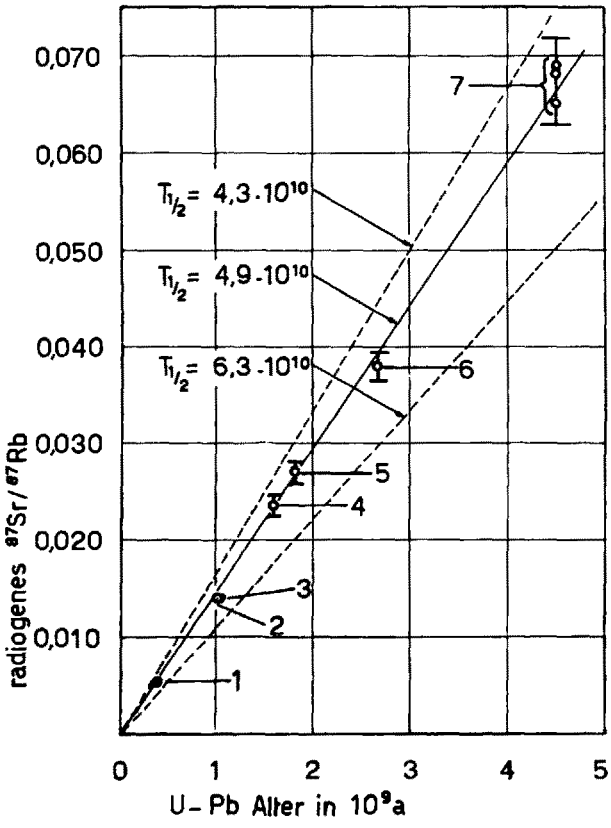
[5] L. T. ALDRICH, G. W. WETHERILL, G. R. TILTON und G. L. DAVIS: im Druck; vgl. Proc. of the Conf. on Nucl Geophysics, Penn. State College (1955). – Ich danke Herrn Dr. ALDRICH für die Bekanntgabe seiner Resultate vor der Publikation.

[6] Vgl. die Literaturzusammenstellung in [5]. Der hohe Wert ist der sogenannte Standardwert, der tiefe derjenige von J. GEESE-BÄNISCH und E. HUSTER, Z. Naturw. *41*, 495 (1954); Z. Physik *142*, 565 (1955). – Herr Dr. E. HUSTER, Marburg, teilte mir freundlicherweise mit, dass die ersten Messungen mit einer verbesserten Technik näher an der «geologischen» Halbwertszeit von $5{,}0 \cdot 10^{10}$a liegen als am früheren Wert aus seinem Laboratorium.

[7] C. C. PATTERSON, Geochim. cosmochim. Acta *7*, 151 (1955).

Summary

Measurements of the radiogenic $^{87}Sr/^{87}Rb$ ratio of the chondritic meteorite Forest City are discussed in the light of a new determination of the half-life of ^{87}Rb. Earlier conclusions are confirmed.



Korrelation des $^{87}Sr(rad.)/^{87}Rb$-Verhältnisses von Glimmern mit dem U-Pb-Alter kogenetischer Uranmineralien. Messpunkte 1–6 von ALDRICH *et al.*[5], 7 von SCHUMACHER. *1* Chestnut Flat Mine, Spruce Pine, N. Carolina; *2* Cardiff Uranium Mine, Cardiff Twsp., Ontario, Canada; *3* Fission Mine, Wilberforce, Ontario, Canada; *4* Bob Ingersoll Mine, Keystone, So. Dakota, US; *5* Viking Lake, Saskatchewan, Canada; *6* Bikita Quarry, S. Rhodesia, S. Africa; *7* Forest City, Meteorit, Fallprobe von H. N. NININGER, American Meteorite Museum, Winslow, Arizona, US.

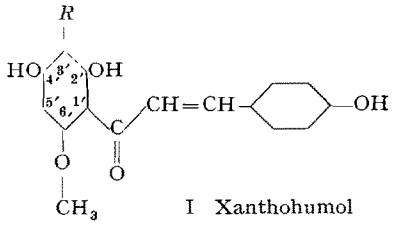
Xanthohumol

Xanthohumol is a yellow coloured substance with mp 172°, present in all hop varieties in concentrations up to 0·3%. It was already described by POWER, TUTIN, and ROGERSON[1] but given the wrong molecular formula. A new investigation showed this substance to be a chalkone with the molecular formula $C_{21}H_{22}O_5$. In cold alkaline solution, isomerization into the corresponding flavanone takes place. This flavanone has mp 198° and is called isoxanthohumol. The reverse reaction can occur and in alkaline solution an equilibrium is reached.

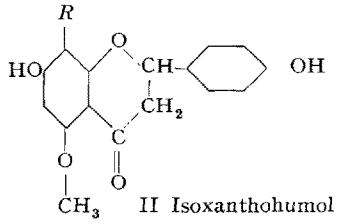
[1] F. B. POWER, F. TUTIN, and H. ROGERSON, J. chem. Soc. *1913*, II, p. 1267.

The position of the equilibrium is, curiously enough, dependent on the alkali concentration.

Xanthohumol and isoxanthohumol must be given the structures I resp. II ($R = (CH_3)_2C = CH-CH_2-$).



I Xanthohumol



II Isoxanthohumol

The place of the R-group is not yet definitely known; it might as well be placed at position 5.

Structures I and II are derived principally from the following facts:

(1) Xanthohumol contains three, and isoxanthohumol two active hydrogen atoms.

(2) On catalytic hydrogenation (Pt) xanthohumol consumes two moles, isoxanthohumol one mole of hydrogen.

(3) Alkaline hydrolysis of xanthohumol yields p-hydroxybenzaldehyde, acetic acid and methylisoprenylphloroglucinol (mp 55°).

(4) Methylisoprenylphloroglucinol and its reduction compound, methylisoamylphloroglucinol (mp 100°) were recognized through the reaction products of their fusion with alkali. The phloroglucinol ring is split and the usual double bond shift occurs. The reaction products were, respectively, isovaleric and acetic acid, and isoheptylic and acetic acid.

(5) Methylisoprenylphloroglucinol, xanthohumol and isoxanthohumol all yield acetone on ozonolysis.

Full details about these reactions, the extraction procedure for xanthohumol, as well as a large number of other facts, all consistent with the formulation put forward, will be published elsewhere.

F. GOVAERT, M. VERZELE, M. ANTEUNIS, F. FONTYN, and J. STOCKX

Laboratory for Organic Chemistry, University of Ghent, Belgium, November 12, 1956.

Résumé

Le pigment jaune du houblon (xanthohumol), isolé par POWER, TUTIN et ROGERSON en 1913, est une chalcone (formule I). L'isomérisation en milieu alcalin du xanthohumol donne la flavanone correspondante (isoxanthohumol-humulol).

A Possible Link from the Cytoplasmic Metabolic Reactions to the Genes: The Co-enzymes

In thinking about cell growth and cell division, the question has often arisen—how does the cell know when to divide? A more complete question might be—what is the biochemical sequence of events that takes place in a cell, beginning at the birth of the cell and ending in its death, taking into account all intermediate activities.

Well, this observer is unable to answer this question, but simply wishes to give a possible partial answer to the first question—a way in which the co-enzymes, DPN, TPN, FAD, CoA and others of a similar nature might function as messengers from the cytoplasm to the nucleus, to the genes and chromosomes.

During some experiments on the isolation of nucleotide pyrophosphatase[1] (a DPN-splitting enzyme) from potatoes and alcohol dehydrogenase[2] (an enzyme which uses DPN as a coenzyme) from yeast, the question arose in the observer's mind—what is the function in the cell of an enzyme that splits DPN? DPN is a useful co-enzyme, a stepping-stone in oxidative pathways, why should the cell itself split this compound, thus reducing the amount available as co-enzyme?

In addition, there are reports in the literature of enzymes which split other co-enzymes.

If one looks at the structure of the co-enzymes, one can see features they have in common. They each have a nucleotide side and a side which functions in the cell metabolism.

Take DPN as an example. Every time two hydrogen atoms are transferred through to oxygen, one molecule of DPN is reduced and re-oxidized. This activity is thought to occur on the nicotinamide side of the molecule. What function does the nucleotide fragment of the molecule serve?

In answer, suppose that DPN is functioning actively, say 19 molecules being reduced, then oxidized, and when the 20th is reduced, it is unable to be re-oxidized (it might be an isomer, thus placing its active group in the wrong position to be oxidized by its oxidizing enzyme, but in the proper position to be split by a DPN-splitting enzyme). The nicotinamide fragment could then be used again or might find its way into the excretory pathways. The nucleic acid isomer could then find its way to the chromosome, where it could polymerize into a space left for it, in the growing chromosomal polymer.

Here is, then, the bare outline of a mechanism by which the chromosome may know how much metabolism has proceeded in the cell. As the nucleotide fragments of the co-enzymes associated with the various metabolic cycles return to the chromosome, the chromosome grows in proportion to the amount of oxidation-reduction which has taken place and perhaps also in proportion to the degree of completion of other processes in which nucleotide co-enzymes are involved.

The actual length and structural configuration of the chromosome would then mirror the number of metabolic cycles in the cell.

The above would probably be only one phase of the cell's life. The process is probably repeated many times (the nucleic acids leaving the chromosome, then returning in a different pattern) as the cell grows, metabolizes, matures, ages, then dies.

Each new set of chromosomes that form during the life of the cell is probably very similar to the previous set,

[1] A. KORNBERG and W. E. PRICER, J. biol. Chem. *182*, 763 (1950)
[2] E. RACKER, J. biol. Chem. *184*, 313 (1950).