EXTRATERRESTRIAL ENIGMA: MISSING AMINO ACIDS IN METEORITES

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Amino acids have been found in interstellar clouds and in meteorites - but with some enigmatic omissions and tantalizing similarities to life on Earth. Just why some amino acids are present in meteorites and others are absent, and why they seem to prefer the same "left-handed" molecular structure as Earth's living amino acids are questions that could unravel one of the most fundamental questions of science: Where and how did life begin?

"The bottom line is that you have these materials that come from space," says Steve Macko, professor of environmental sciences at the University of Virginia in Charlottesville. Macko refers specifically to eight of the amino acids found in a certain kind of meteorite - a carbonaceous chondrite. All eight amino acids are identical to those used by life on Earth. That could seem to point to a cosmic origin of these basic biological building blocks, says Macko. The case is bolstered by the fact that early Earth was bombarded with meteorites and the amino acid glycine has been detected on interstellar molecular clouds.

Making the case for cosmic origins of Earth's amino acids even more compelling is the fact that all of the meteorite amino acids, except glycine, favor the "left-handed" molecular structure, or chirality, that is also favored by life on Earth. The preference for left-handed amino acids was a necessary precondition for life, but just why life chose left (L-amino acids) over right (D-amino acids) is a mystery.

"Essentially all of your protein is made of L-amino acids," said Macko. "Why is that? We don't know. The curious thing is that if you go to a meteorite you find a predominance of the same thing."

Another unanswered question: Why have only eight of life's 20 amino acids been found in meteorites? Perhaps all the amino acids were there, but something about the history of the meteorites or the analytical processes used limited their presence or their detection, Macko speculates.

Only in recent years has the idea of amino acids from space affecting the start of life on Earth become a plausible hypothesis, explains Macko. Initially, amino acids were thought to have been created in the primordial atmosphere of early Earth. In a now famous experiment more than a half-century ago, Stanley Miller and Harold Urey showed that amino acids were synthesized by simply creating lightning-like electrical discharges through a fog of water, methane and ammonia - all of which were thought to be readily available in Earth's early years. The experiment was proof that amino acids, out of which all life's proteins are made, can be created by strictly physical-chemical processes, without the help of living organisms.

Perhaps the most famous carbonaceous chondrite was the Murchison meteorite, which fragmented and fell in 1969 in and around the small town of Murchison, Victoria, about 70 miles north of Melbourne, Australia. Amino acids and other organic molecules were found in the Murchison meteorite. The mix of amino acids found in the Murchison Meteorite was similar to those produced in Miller-Urey type experiments. A chief difference, however, was seen by Mike Engel in his PhD research: Unlike the Miller-Urey experiment which produced equal amounts of the D and L- amino acids, Murchison tended to have l-amino acids predominate. The fact that the meteorite was seen falling and fragments were collected quickly minimized the chances that they were contaminated by Earth amino acids.

extraterrestrial	mimozemský
enigma	hádanka, záhada
missing	chybějící
amino acid	aminokyselina
have been found	byly nalezeny
interstellar	mezihvězdný
cloud	oblak
but	ale
with	s
some	nějaký, některý
enigmatic	záhadný, nevysvětlitel.
omission	vynechání, zanedbání
tantalizing	napínavý, týrající (nadějí)
similarity	podobnost
to life	pro život
on Earth	na Zemi
just why	proč právě
present	přítomen
others	jiné, ostatní
absent	nepřítomný, chybějící
they	oni
seem to prefer	zdá se, že dávají přednost
same	stejný
left-handed	levotočivý
molecular	molekulární
structure	struktura, stavba
as Earth's living	jako pozem. Života
question	otázka
that could	které mohou
unravel	rozplést, rozmotat
one of	jeden z
most fundamental	nejzákladnější
science	věda
where and how	kde a jak
begin	začít
bottom line is	„je třeba zdůraznit“
these materials	tyto materiály
come from space	pocházejí z vesmíru
say	říkat
professor	profesor
environmental sciences	vědy o životním prostředí
refer	odkázat, odvolávat se, upozornit
specifically	speciálně, konkrétně
eight	osm
certain	jistý, určitý
kind	druh
carbonaceous chondrite	uhlíkatý chondrit
all	všechny
identical	identický
those used by	těm, které využívá…
could seem to point to	mohlo by ukazovat na
cosmic origin	vesmírný původ
basic building block	“základní stavební kámen”
biological	biologický
case	případ, záležitost
bolster	podložit, podepřít
by the fact	skutečností
early Earth	ranná (mladá) Země

The Miller-Urey experiment, combined with the discovery of amino acids in carbonaceous chondrites and the detection of glycine in molecular clouds, raise compelling issues about the origin of life on Earth, and its possible existence elsewhere in the solar system and beyond.

Redakčně zkráceno.

*) pozn.: český překlad slova *chirality* ani *chiral* se mi nepodařilo nalézt v žádném slovníku, proto jsem ho přeložil jako „chiralita“. Odborné texty ale říkají, že *chirality* znamená „existence pravého a levého obrazu, nebo prostě fakt, že předmět a jeho obraz v zrcadle nevypadají totožně“.

methane	metan
ammonia	čpavek
all of which	což vše
readily	snadno, ochotně
available	dostupný
proof	důkaz
out of which	z nichž
can be	mohou být
strictly	přísně
process	proces
without help	bez pomoci
living organism	živý organismus
fragment	rozpadnout se
fell	spadl
around	okolo
small town	malé město
about	asi, okolo
north of	severně od
organic	organický
mix	směs
similar	podobný
produce	vyrobit
chief difference	hlavní rozdíl
however	nicméně
was seen by	uviděl...
his research	jeho výzkum
unlike	na rozdíl od
equal amount	stejné množství
tend	mít sklon, směřovat
predominate	převládat
collect	sesbírat, sbírat
quickly	rychle
minimize	minimalizovat
chance	šance, možnost
contaminate	znečistit
combine	spojit, slučovat
discovery	objev
raise	vznést, vystavět
issue	“téma, výsledek”
possible	možný
elsewhere	jinde
solar system	sluneční soustava
beyond	mimo, za, dále
bombard	bombardovat
detect	objevit, odhalit
making...even more compelling	... dělá ještě více zajímavé
except	kromě, vyjma
favor	dávat přednost
chirality	chiralita *)
that is also	který je také
preference	přednost, preference
necessary	nezbytný, nutný
precondition	předpoklad
chose	vybral
left over right	levé před (nad) pravými
mystery	záhada, tajemství
essentially	v podstatě
your	vaše
protein	bílkovina
made of	vyroben z
we don’t know	nevíme
curious thing	podivná věc
if you go to	“pokud se podíváte do”
find	nalézt
predominance	převaha
another	jiný, ještě jeden
unanswered	nezodpovězený
only	pouze
perhaps	snad, možná
there	tam
something about	“něco jako”
history	historie, dějiny
analytical process	analytické zpracování
limit	omezit
presence	přítomnost
detection	odhalení, detekce
speculate	spekulovat
recent years	poslední roky
idea	myšlenka
affect	způsobit
become	stát se
plausible	přijatelný, možný
hypothesis	hypotéza
explain	vysvětlit
initially	původně, zpočátku
were thought to be	“myslelo se, že”
create	stvořit, vytvořit
primordial	prvotní
atmosphere	atmosféra
now	dnes, nyní
famous	slavný
experiment	pokus
more then	více než
half-century ago	před půl stoletím
show	ukázat
synthesize	syntetizovat
simply	jednoduše
lightning-like	jako blesk
electrical discharge	elektrický výboj
through	skrz
fog	mlha
water	voda

Připravil Petr Scheirich
Anglický list vychází jako příloha Bílého Trpaslíka, zpravodaje Amatérské prohlídky oblohy.