

Arthur Holmes' scientific legacy



Cherry Lewis

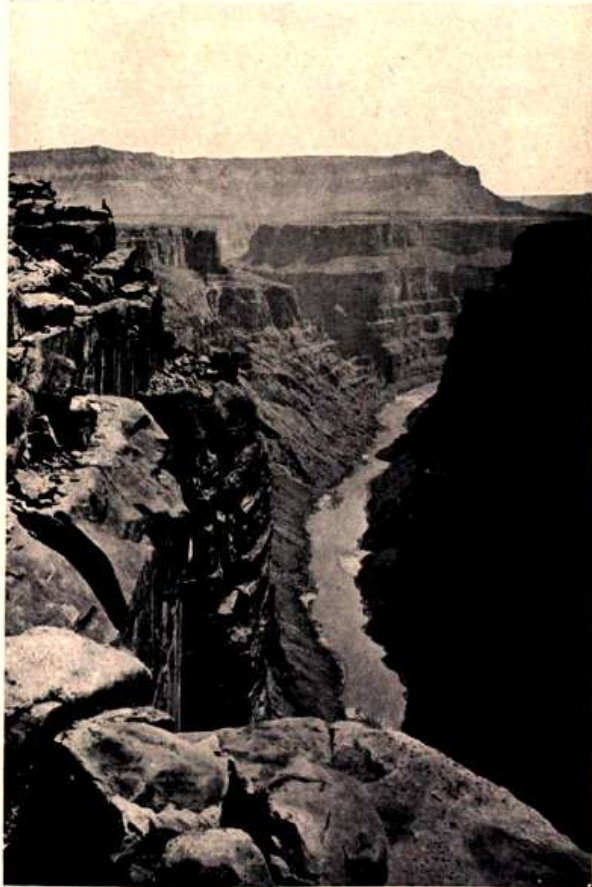
Honorary Research Fellow
Department of Earth Sciences
University of Bristol

cherry.lewis@bristol.ac.uk



(1890 – 1965)

PLATE I



[Hillers, U.S. Geol. Survey]
Grand Canyon of the Colorado River, Arizona

PRINCIPLES OF PHYSICAL GEOLOGY

ARTHUR HOLMES D.Sc. F.R.S.

*Regius Professor of Geology and Mineralogy
University of Edinburgh*

95 Plates and 262 Text Illustrations



PRINCIPLES OF GEOLOGY,

AN ATTEMPT TO EXPLAIN THE FORMER CHANGES
OF THE EARTH'S SURFACE,

BY REFERENCE TO CAUSES NOW IN OPERATION.

BY
CHARLES LYELL, ESQ., F.R.S.

FOR. SEC. TO THE GEOL. SURV. &c.

IN TWO VOLUMES.

VOL. I.

LONDON:
JOHN MURRAY, ALBEMARLE-STREET.

MDCCLXXXV.



University of
BRISTOL

🔥 Preface to *Principles*



I have long felt the need for a thoroughly up-to-date book on Physical Geology ... it is hoped that the book will appeal not only to students and teachers ...but also to the general reader who wishes to see something of the “wild miracle” of the world we live in through the eyes of those who have tried to resolve its ancient mysteries.



I received a copy of his text book on *The Principles of Physical Geology* for my seventeenth birthday. It was spellbinding, read like poetry, and I could not put it down.

Arthur Warden

Arthur Holmes' book on *Physical Geology* brought back memories of my schooldays in the early 1960s when I studied Geology at "A" level. I subsequently became an architect, but my general interest in the earth sciences has continued up to the present time. **Robin Roberts**

I had for a long time been interested in geology in a school-boyish way – had inherited my father's Lyell – but *this* was perhaps one of the most decisive influences in my determining to 'become a geologist'. Yes, Arthur Holmes – and The Book – must have inspired legions of people. **John Hepworth**

The first edition of '*Principles of Physical Geology*' was an inspiration to me: ahead of its time, so comprehensive, so very well written.

Charles Holland



Dan McKenzie

I have a profound admiration of Holmes and have repeatedly used his ideas in my own research.

I used Arthur Holmes' *Principles* as the text in my university courses (in New Zealand, early 1950s) and thought it was a truly out-standing piece of synthesis and clarity of prose and presentation.


Graeme Stevens

Like many another, delving into the *Principles* I found myself captivated by the facts and concepts he revealed in such a readable style. I was particularly struck by Holmes' portrayal of a mobile and ever-changing planet. **Gilbert Kelling**



University of
BRISTOL

Dan McKenzie, interviewed by Paul Merchant, 15th July 2010, An Oral History of British Science, reference C1379/24 track 4, The British Library.



Kingsley Dunham: To say that I was fascinated by his first year lectures is a great understatement. It was the really delightful lectures by Holmes to his quite sizeable first year class that first introduced me to the subject.

John Davies: I am a Durham graduate and I still have fond memories of Level I Geology under the guidance of the estimable Professor Holmes. Even in the 1950s prospective chemistry majors were switching over to geology on the strength of those introductory lectures.

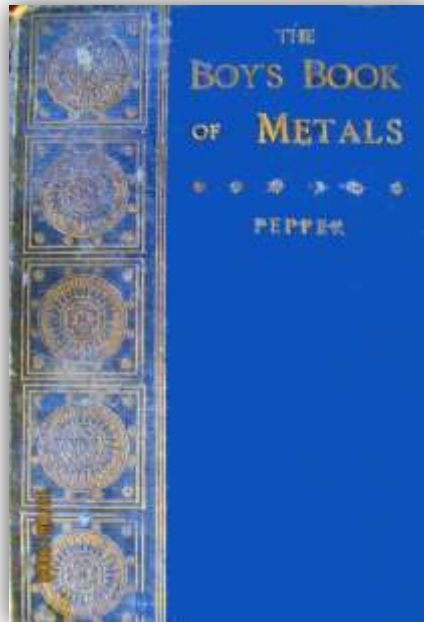
George Bennison: His lectures were so fascinating that quite often I found that I had just been listening and not taking notes.

Arthur Warden: No wonder the lecture theatre was packed with mainly female arts students who overwhelmingly opted for geology as their compulsory science and enthusiastically absorbed our Prof's words of wisdom.

Peter Banham: I used to say to students that your proudest boast will be that you were taught by a man who was taught by a man (my supervisor Brian Elliott) who was taught by Arthur Holmes.

Dave Mackenzie: Holmes' brilliant lectures did a wonderful job to draw into geological studies many students who had started with other intentions...

🔥 Influences on Holmes?



THE BOY'S BOOK OF METALS

INCLUDING

*PERSONAL NARRATIVES OF VISITS TO COAL,
LEAD, COPPER, AND TIN MINES*

WITH

*A Large Number of Interesting Experiments
RELATING TO ALCHEMY AND THE CHEMISTRY OF THE FIFTY
METALLIC ELEMENTS*

BY

JOHN HENRY PEPPER

AUTHOR OF "THE PLAYBOOK OF SCIENCE."

With Three Hundred Illustrations

EIGHTH EDITION.

LONDON
GEORGE ROUTLEDGE AND SONS

BROADWAY, LUDGATE HILL
NEW YORK: 9 LAFAYETTE PLACE



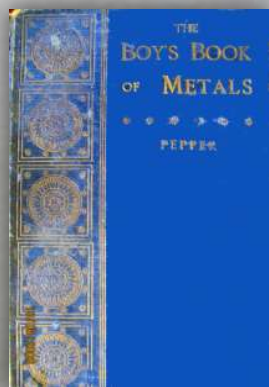
University of
BRISTOL

Master Arthur Holmes
wishing him every success
in his future career

from Mr. D.M. 2.1.1902

~~~~~

g. Holmes  
gH



# Formation of coal – 1875

## 1 Drift Theory

‘supposed that vast forests were swept from the land into the arms of the mighty oceans or into vast lakes, by continental inundations or powerful streams ...’

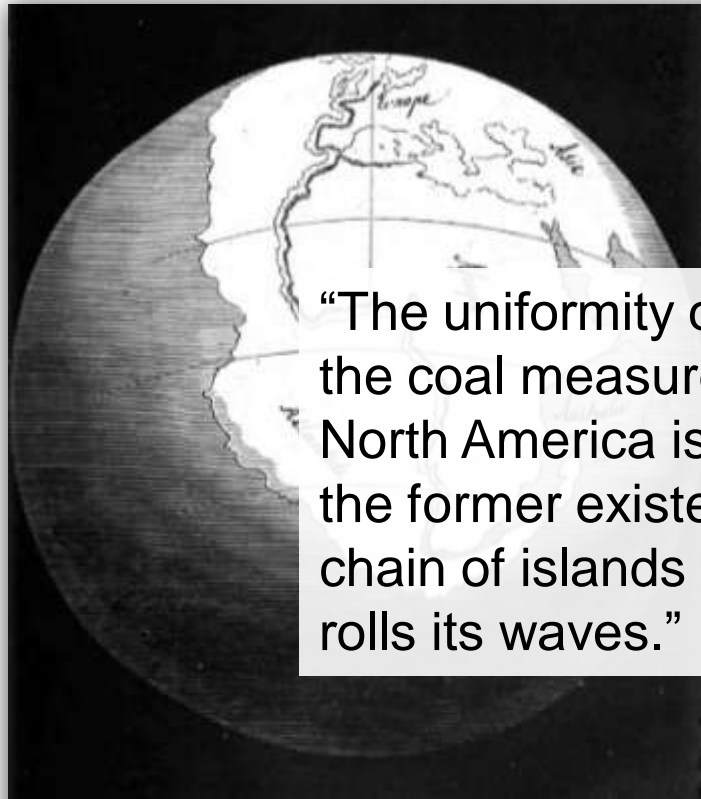
## 2 Submergence Theory

proposed that the trees which formed the coal ‘had never been subjected to drift, *but were buried on the spots where they lived and died.*’





# 🔥 John Pepper – 1875, from Antonio Snider – 1858



“The uniformity of the fossil plants of the coal measures of Europe and North America is convincing proof of the former existence of a continent or chain of islands where the Atlantic now rolls its waves.”



# 🔥 Arthur Holmes - 1944

## CONTINENTAL DRIFT

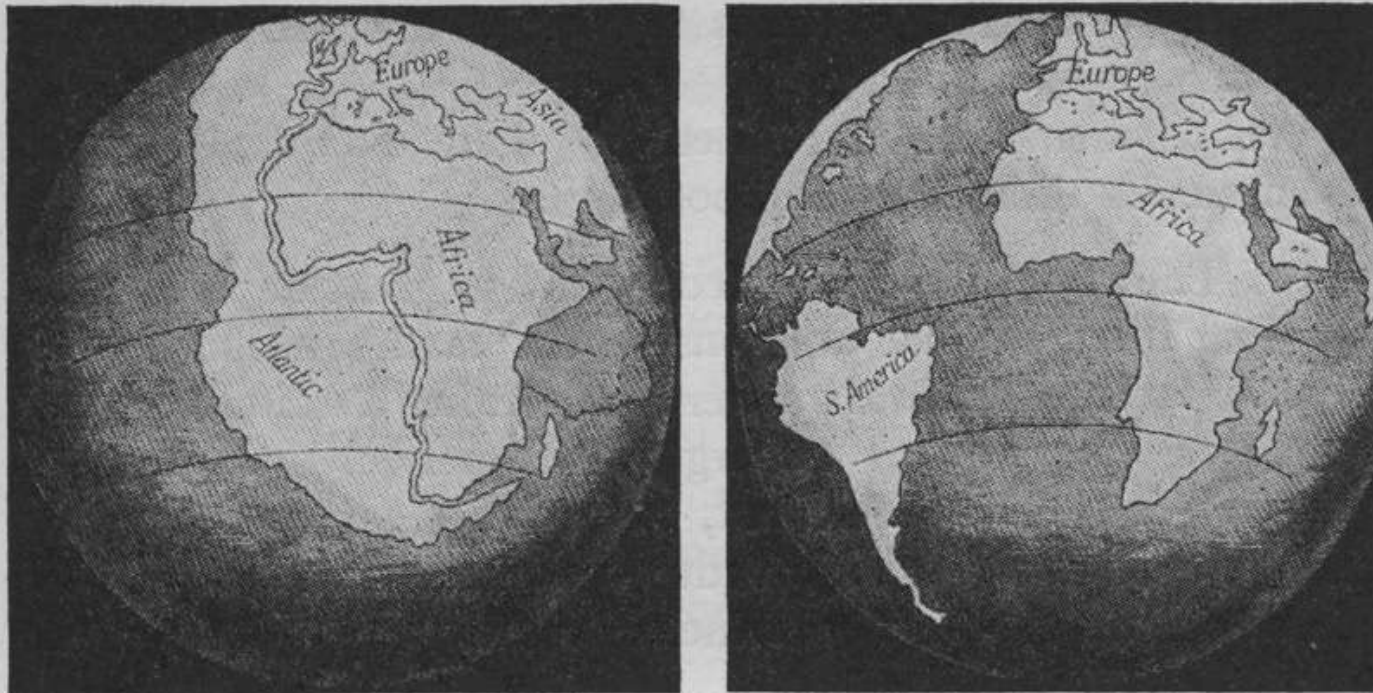


FIG. 256

Maps published by A. Snider in 1858 to illustrate his conception of continental drift. The left-hand map represents the supposed coalescence of the continents in late Carboniferous times



University of  
BRISTOL

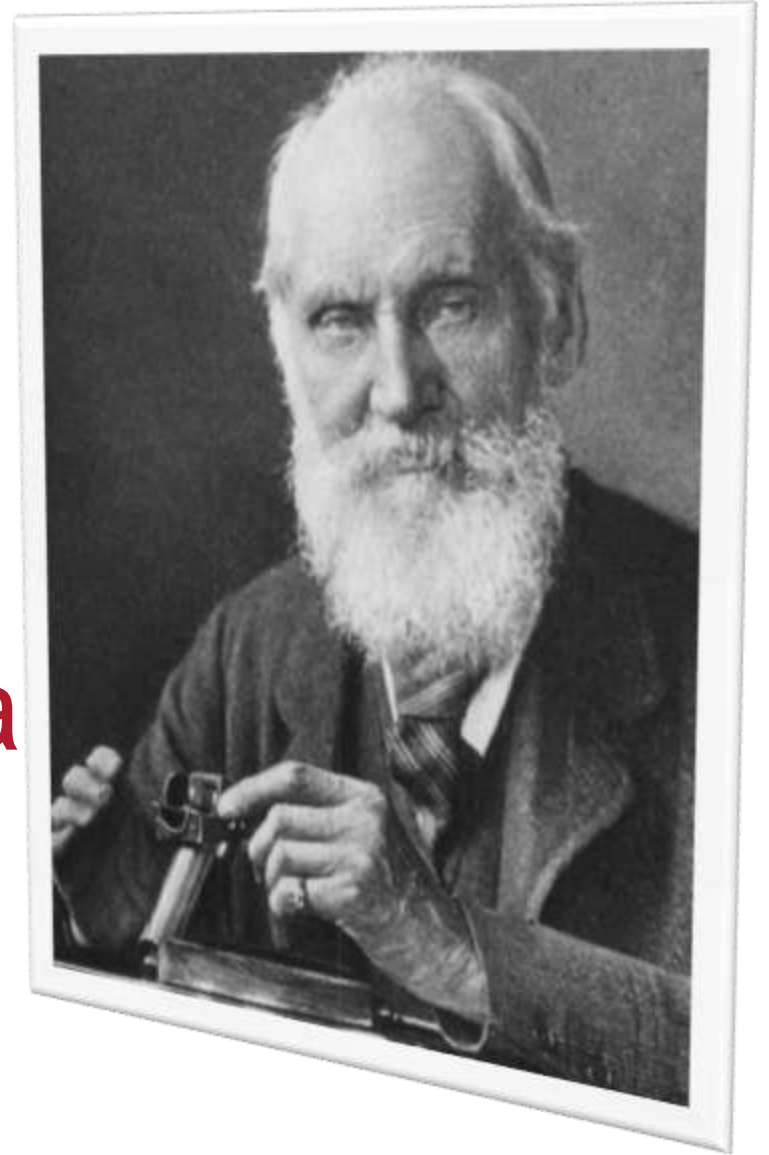
# 🔥 Date of Creation: 4004 BC



*I was puzzled by the odd '4'.  
Why not a round 4000 years?  
And why such a recent date?  
And how could anyone know?*

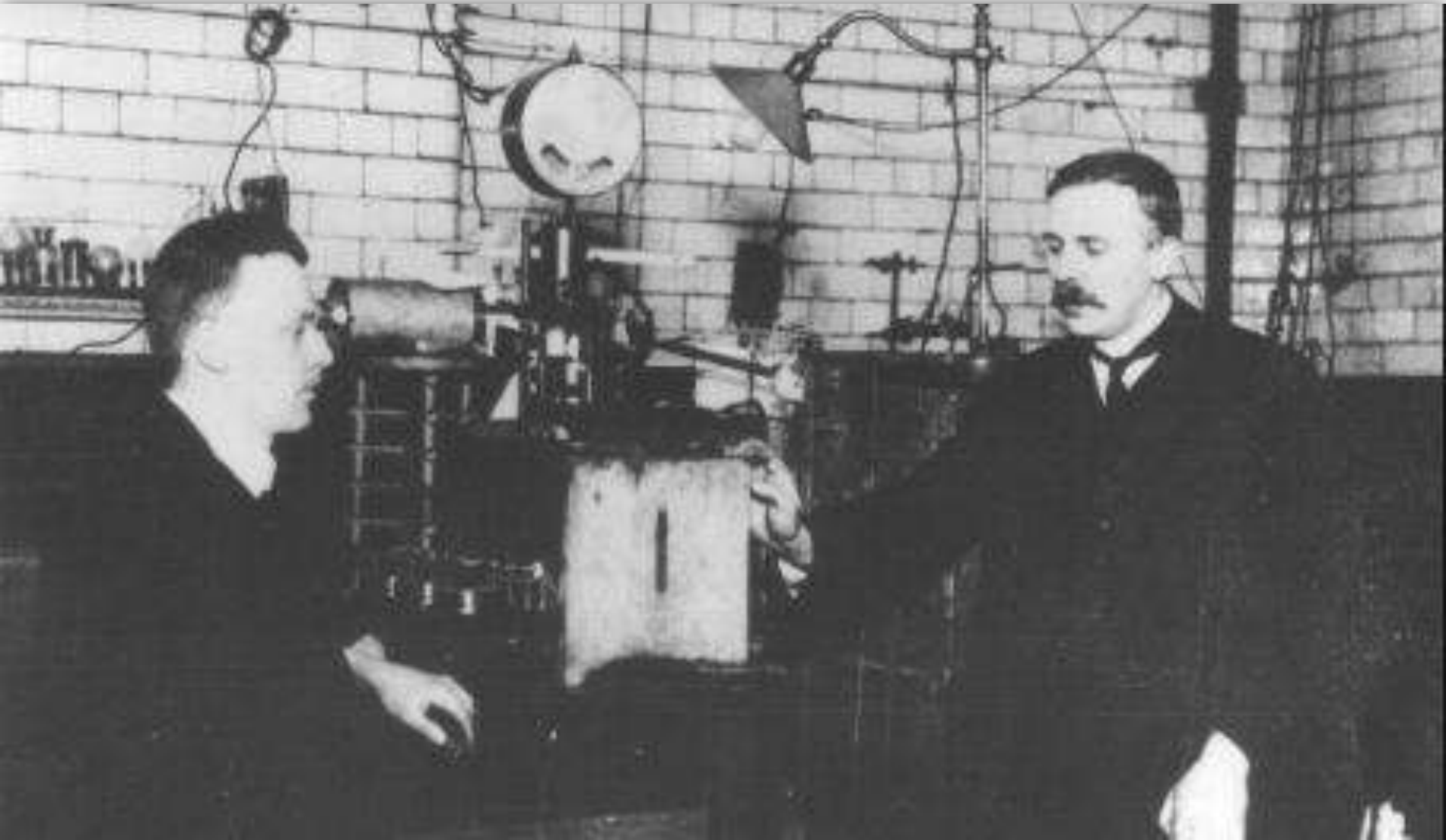


🔥 Kelvin in 1899:  
Age of the Sun  
and Earth = 20 Ma





# 🔥 Fritz Geiger and Ernest Rutherford (right), Manchester 1904



# ✶ Excelled at school (1901-1907)

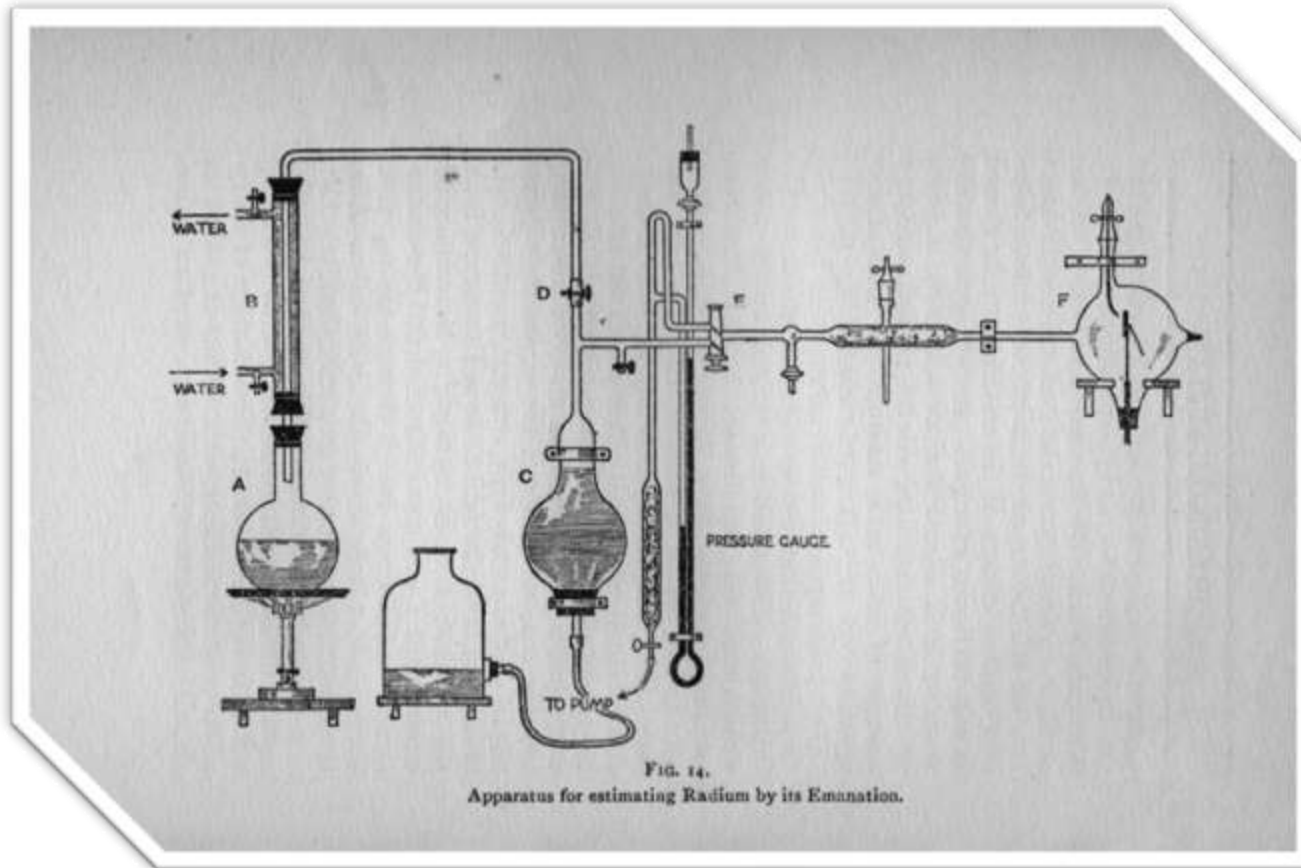
## First in:

- *Physics*
- *Chemistry*
- *Mathematics*
- *Mechanics*
- *English*

Talented pianist



# 🔥 Holmes' tutor, Robert Strutt (1875-1947)



‘Apparatus for  
estimating radium by  
its emanation [radon]’



University of  
BRISTOL

Holmes' first paper:  
Proceedings of the  
Royal Society (A),  
85, 248-256.

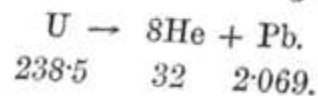
*The Association of Lead with Uranium in Rock-Minerals, and its  
Application to the Measurement of Geological Time.*

By ARTHUR HOLMES, A.R.C.S., B.Sc., Imperial College of Science and  
Technology.

(Communicated by Prof. the Hon. R. J. Strutt, F.R.S. Received March 20,—Read  
April 6, 1911.)

1. *Introduction.*—The study of radioactive minerals is of great importance from two points of view. Such minerals may be regarded as storehouses for the various series of genetically connected radioactive elements. In them the parent element slowly disintegrates, while the ultimate products of the transformation gradually accumulate. The analysis of these minerals ought, then, in the first place, to disclose the nature of the ultimate product of each series; secondly, a knowledge of the rate of formation of this product, and of the total quantity accumulated, gives the requisite data for a calculation of the age of the mineral.

It has been shown that the disintegration of uranium results in the formation of eight atoms of helium.\* In 1907 Boltwood brought forward strong evidence suggesting that lead is the ultimate product of this disintegration.† In this paper it is hoped to produce additional evidence that such is the case, according to the following equation:—



\* See Strutt, 'Roy. Soc. Proc.,' A, 1908, vol. 81, p. 276.

† Boltwood, 'Am. Journ. Sci.,' 1907, p. 77.





# 🔥 Holmes' first date – 370 Ma

| Geological Period      | Pb/U         | Age (Ma)   |
|------------------------|--------------|------------|
| Carboniferous          | 0.041        | 340        |
| <b>Devonian</b>        | <b>0.045</b> | <b>370</b> |
| Pre-Carboniferous      | 0.050        | 410        |
| Silurian or Ordovician | 0.053        | 430        |
| Pre-Cambrian -         |              |            |
| a. Sweden              | 0.125        | 1025       |
|                        | 0.155        | 1270       |
| b. United States       | 0.160        | 1310       |
|                        | 0.175        | 1435       |
| c. Ceylon              | 0.200        | 1640       |

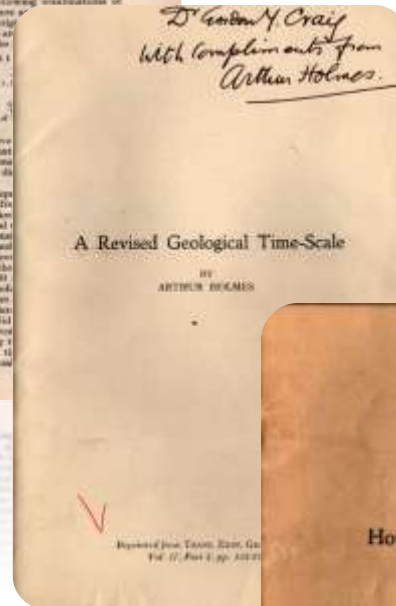
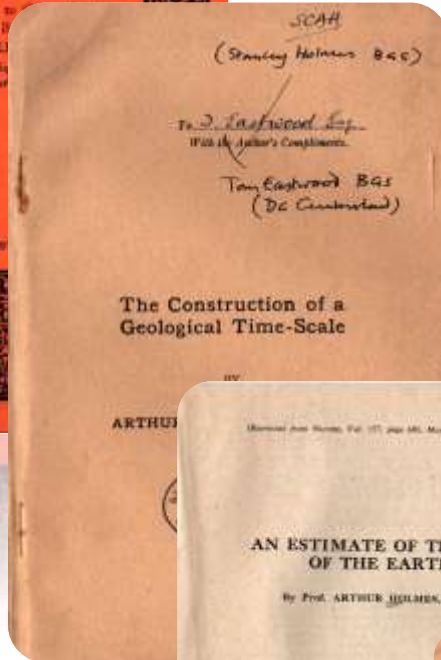
# 🔥 Holmes to Lawson, Mozambique, 1911



Bob Lawson, Holmes' best friend and collaborator on many papers.

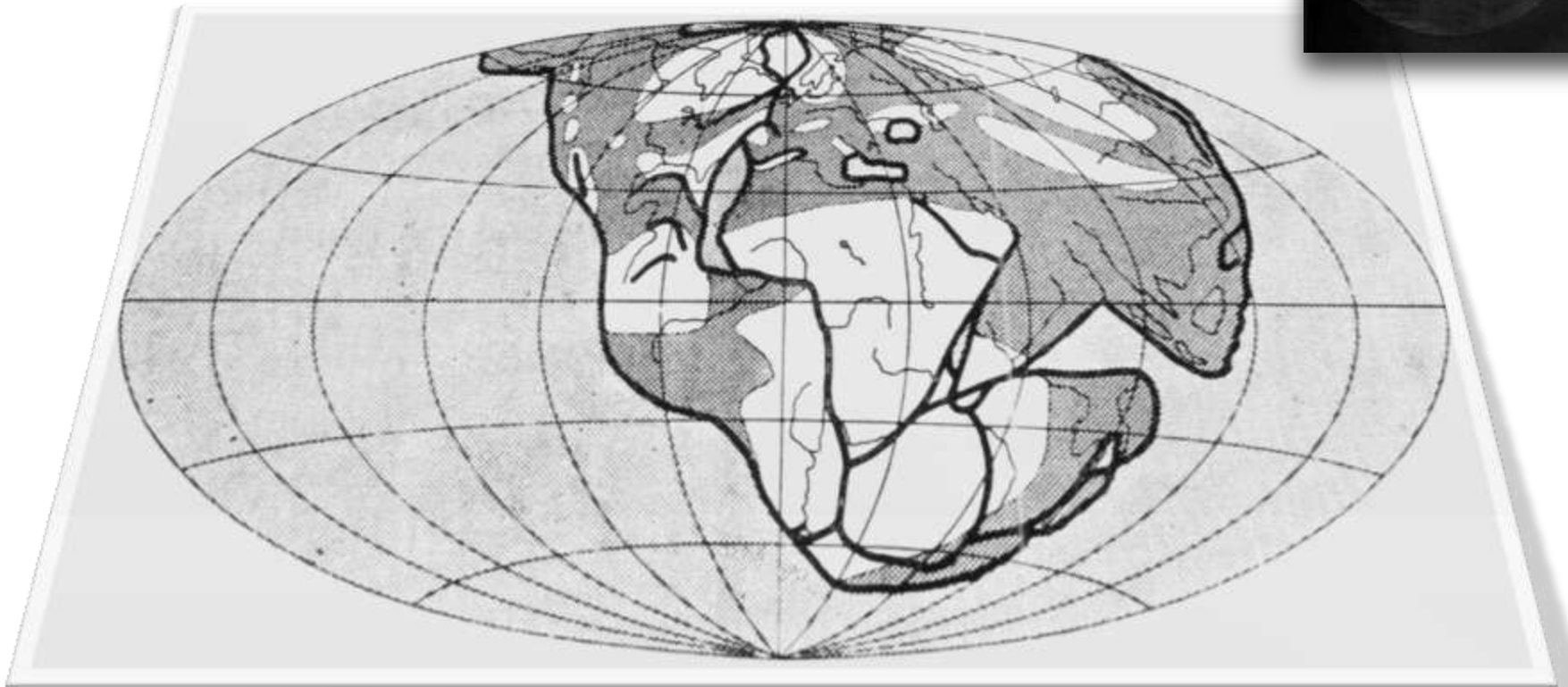
I intend writing all over the world to surveys & societies for material of know geol. age to analyse for U. & Pp. I am in hopes of gradually building up a geol. time scale & hope it might do for a D.Sc. !!! There's conceit if you like ! Still, I may as well confess to you that a D.Sc. is my present aim & object & with other published work I think it ought not now to be far away - if only I can avoid having to pass the Hons B.Sc.

# Constructing a geological timescale





# 🌟 Wegener, 1912



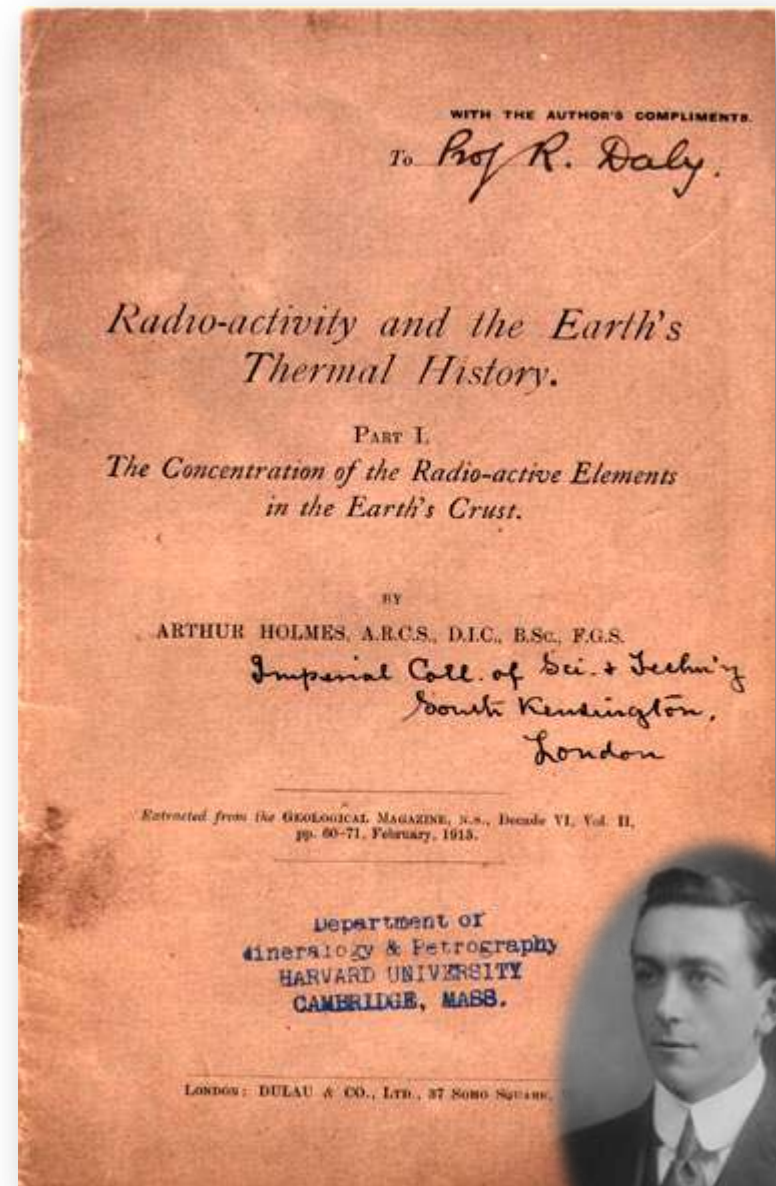
University of  
BRISTOL





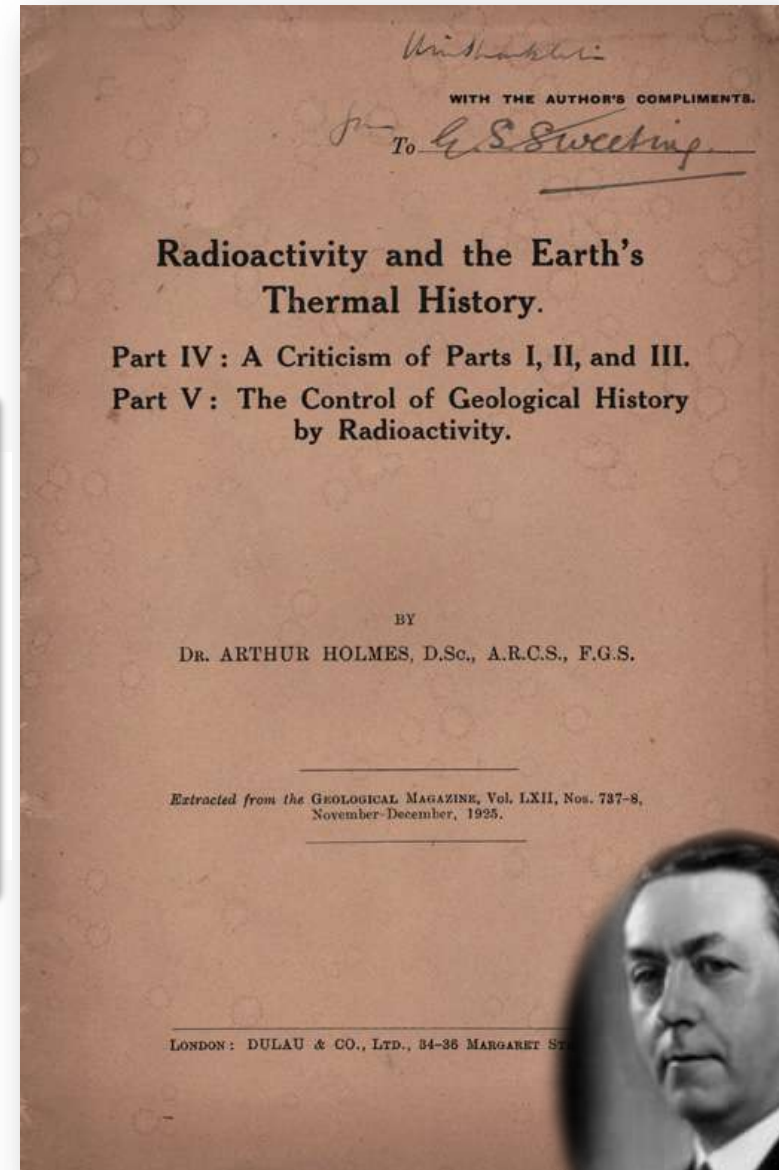
🌟 1915 - 1925

“Radioactivity is a science of fundamental importance ... because it offers to us, as geologists, new data and new methods with which to attack some of our most difficult problems.”



# 🔥 Hallmark of a great scientist

“Nevertheless an attempt must be made, and if mistakes are involved at first, then at least their recognition and correction in the future will mark a beginning of sound progress.”



# 🔥 Christmas 1927



Charles Schuchert (1858-1942)

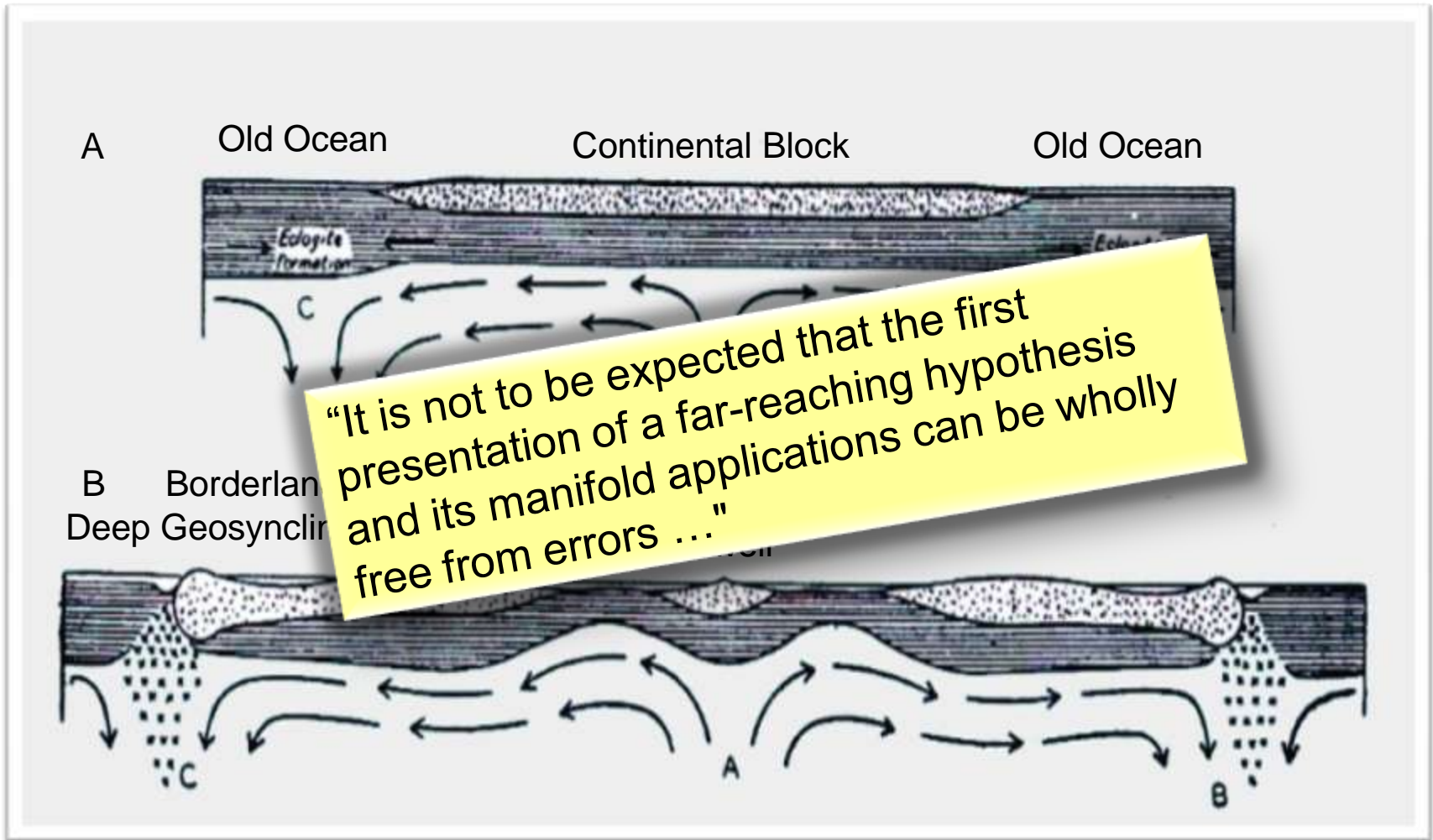


Arthur Holmes (1890-1966)

I am trying to  
develop the idea  
of convection  
currents.



🔥 12 January 1928

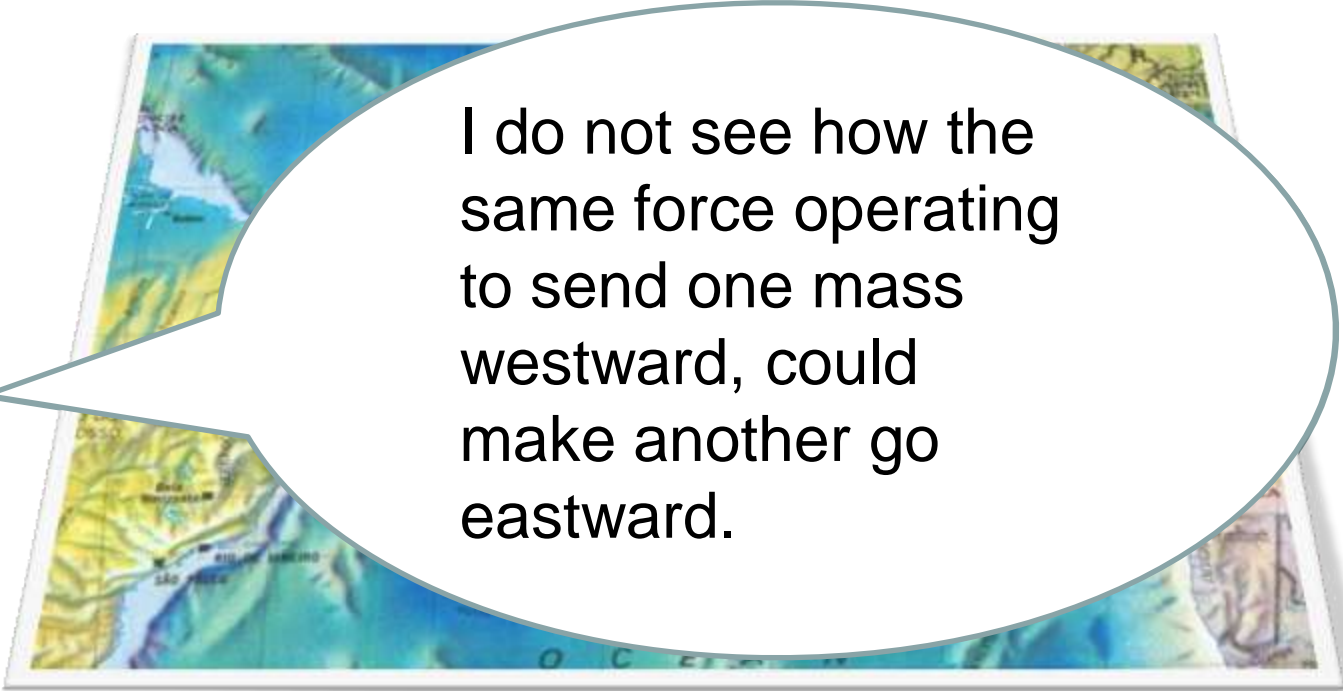




# 🔥 Bowie to Schuchert, 1928



William Bowie  
1872-1940

A map of the Pacific Ocean, showing the Americas on the left and Asia on the right. A large speech bubble is superimposed over the map, pointing towards the left. The text inside the bubble is a quote from William Bowie to Schuchert in 1928.

I do not see how the same force operating to send one mass westward, could make another go eastward.

# 🌟 Arthur Holmes, 1890-1965

With Doris Reynolds, c 1935



## Awarded:

- FRS
- Wollaston Medal
- Penrose Medal
- Honourary Doctorate
- Vetlesen Prize

## Wrote:

- 5 books
- ~ 190 papers
- 'Popular' articles
- Book reviews
- School broadcasts



# Vetlesen prize



*“uniquely distinguished achievement in the sciences resulting in a clearer understanding of the Earth, its history, and its relation to the universe”*

THE TIMES WEDNESDAY APRIL 15 1964



Professor Arthur Holmes (right), Emeritus Professor of Geology and Mineralogy at Edinburgh University, receiving the Vetlesen gold medal from Dr. Maurice Ewing at a luncheon given by the President and Trustees of Columbia University at the Royal Society in London yesterday. Professor Holmes is co-recipient of the 1964 award with another eminent geologist, Professor Pentti Eelis Eskola of Finland. Professor Holmes, who was unable to travel to the United States, will also share a \$25,000 award.



# Arthur Holmes, 1890 - 1965



***“Looking back it is a  
slight consolation for the  
disabilities of growing old***



***to notice that the  
Earth has grown older  
much more rapidly than I have***



***– from about six  
thousand years  
when I was ten, to  
four or five billion  
years by the time I  
reached sixty.”***

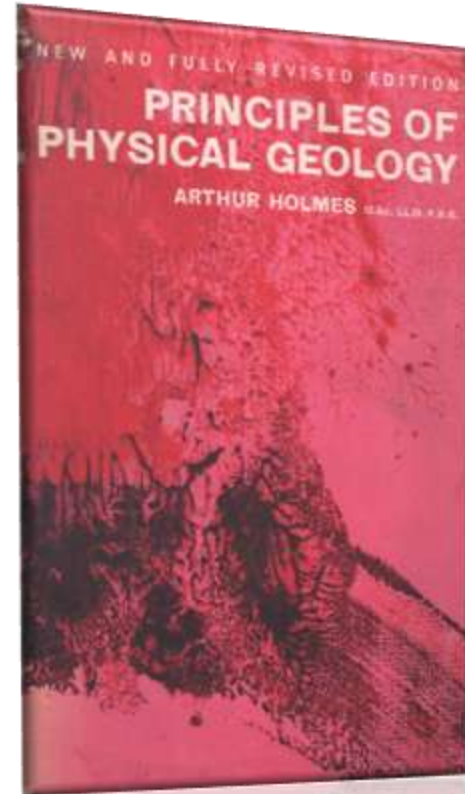




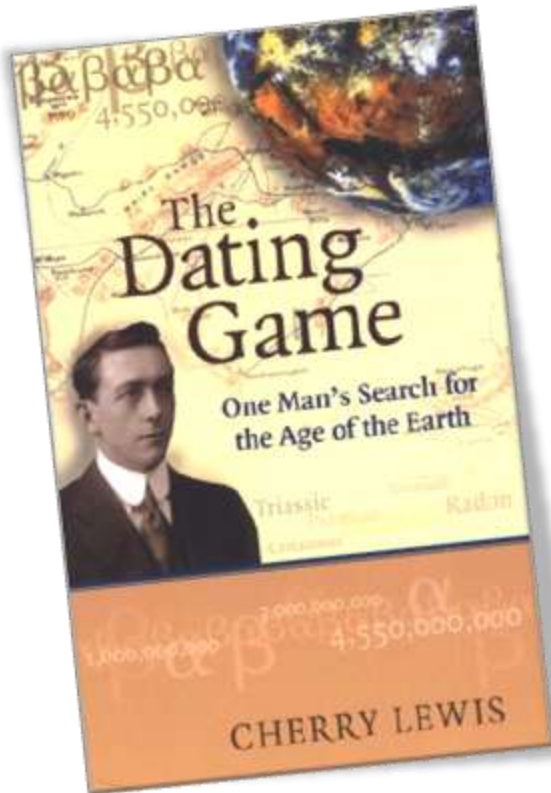
New edition of *Principles*  
published 1965



Arthur Holmes died  
20 September 1965



*"To my wife and fellow geologist, I  
am, as always, more deeply indebted  
than can be adequately expressed."*



# Thank you!

