



LA
NOSTRA
CIÈNCIA
DE
CADA
DÍA



Física i natura
IFISC (UIB-CSIC)
Coordinació: Claudio Mirasso

A, 11 i 18 de novembre



La química
de cada dia
Coordinació: Pere Deyà

3, 10 i 17 de febrer



La crisi
econòmica
Coordinació: Amadeo Spadaro

24 de febrer, 3 i 10 de març



El cel que cau de l'espai
i la seva interacció amb el medi
per tal d'entendre el seu funcionament
i els seus misteris



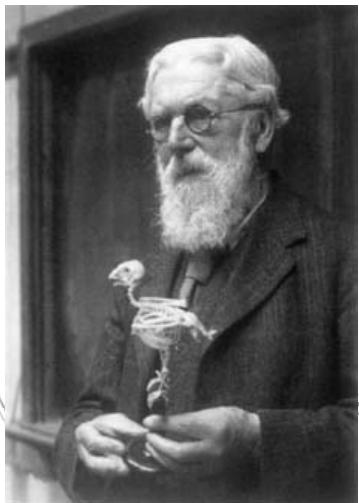
www UIB-CSIC/serveis/SD



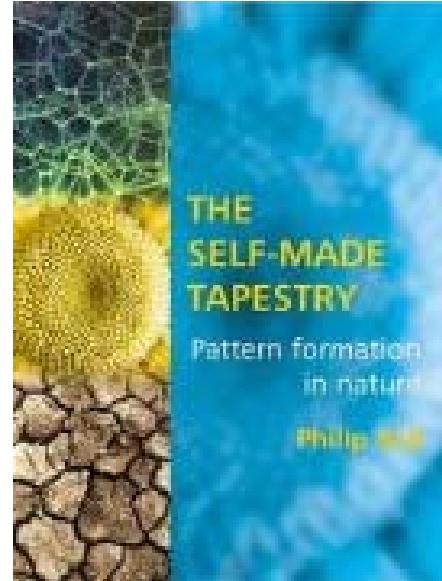
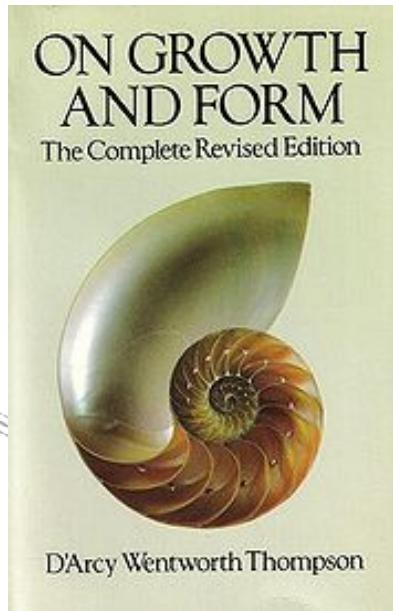
Una ullada a l'entorn: formes i forces de la natura

Emilio Hernández-García

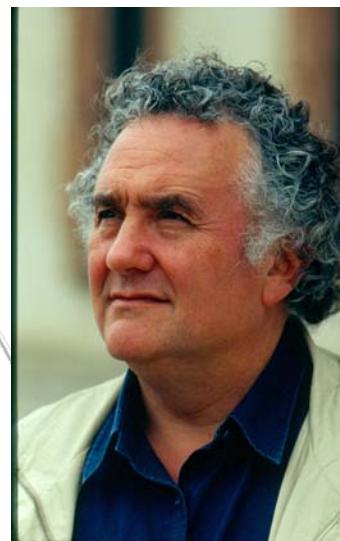
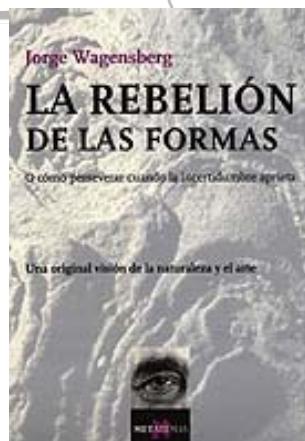
* IFISC



D'Arcy W. Thompson
(1860-1948)

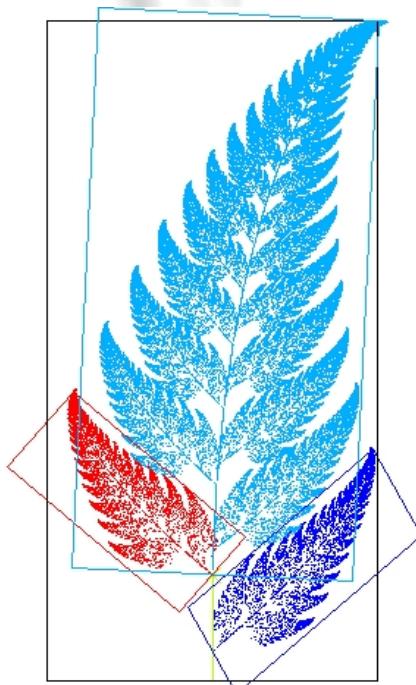


Philip Ball, 1962



Jorge Wagensberg, 1948





FALGUERES

Formes



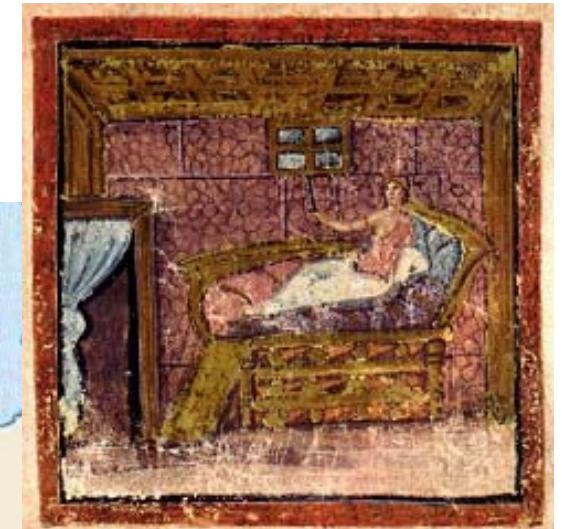
Bròquil Romanescu (by Juanjo Ensenyat)



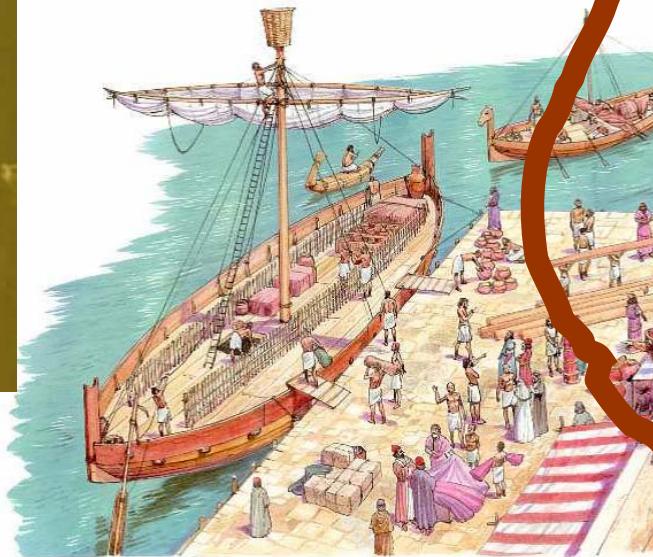


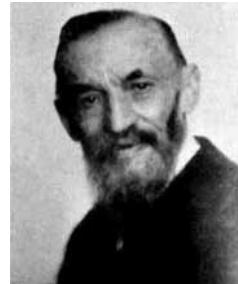
DIDO, o ELISSA DE TIR

apareix a l'Eneida de Virgili
i a escrits d'Ovidi





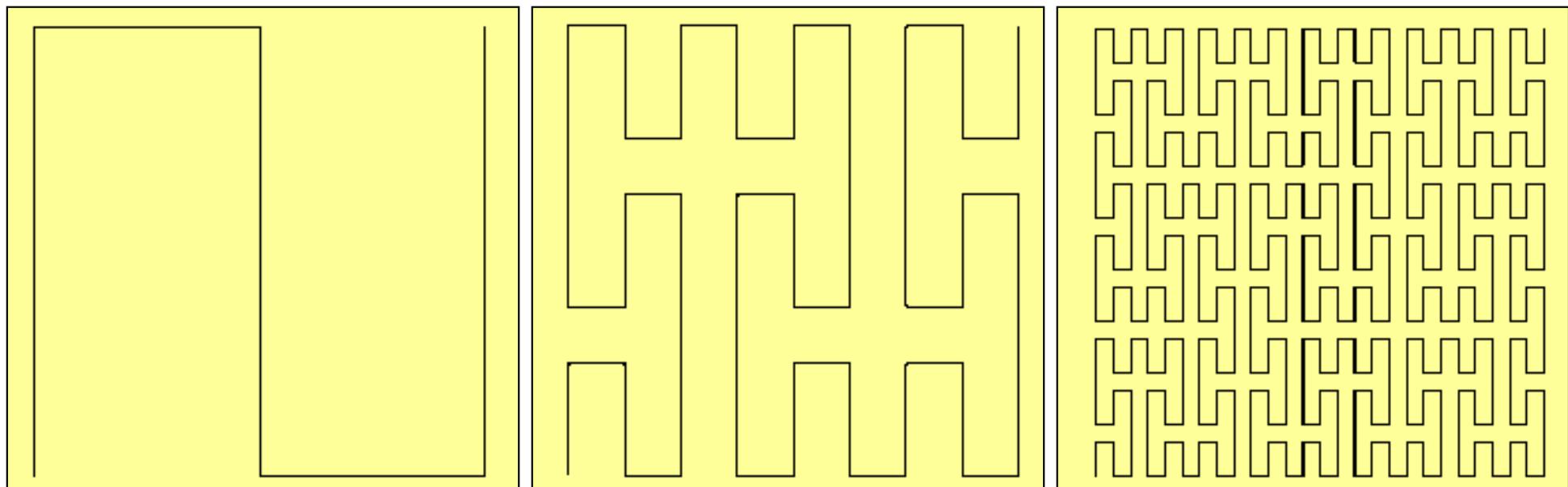




Giuseppe Peano
(1858-1932)

La corba de Peano:
com posar en línia tots els punts d'una superfície

Una corba de **longitud infinita** que cap dintre
d'una àrea finita



OBJECTE FRACTAL



**Es pot ficar Mallorca
dins la pell d'un bou?**

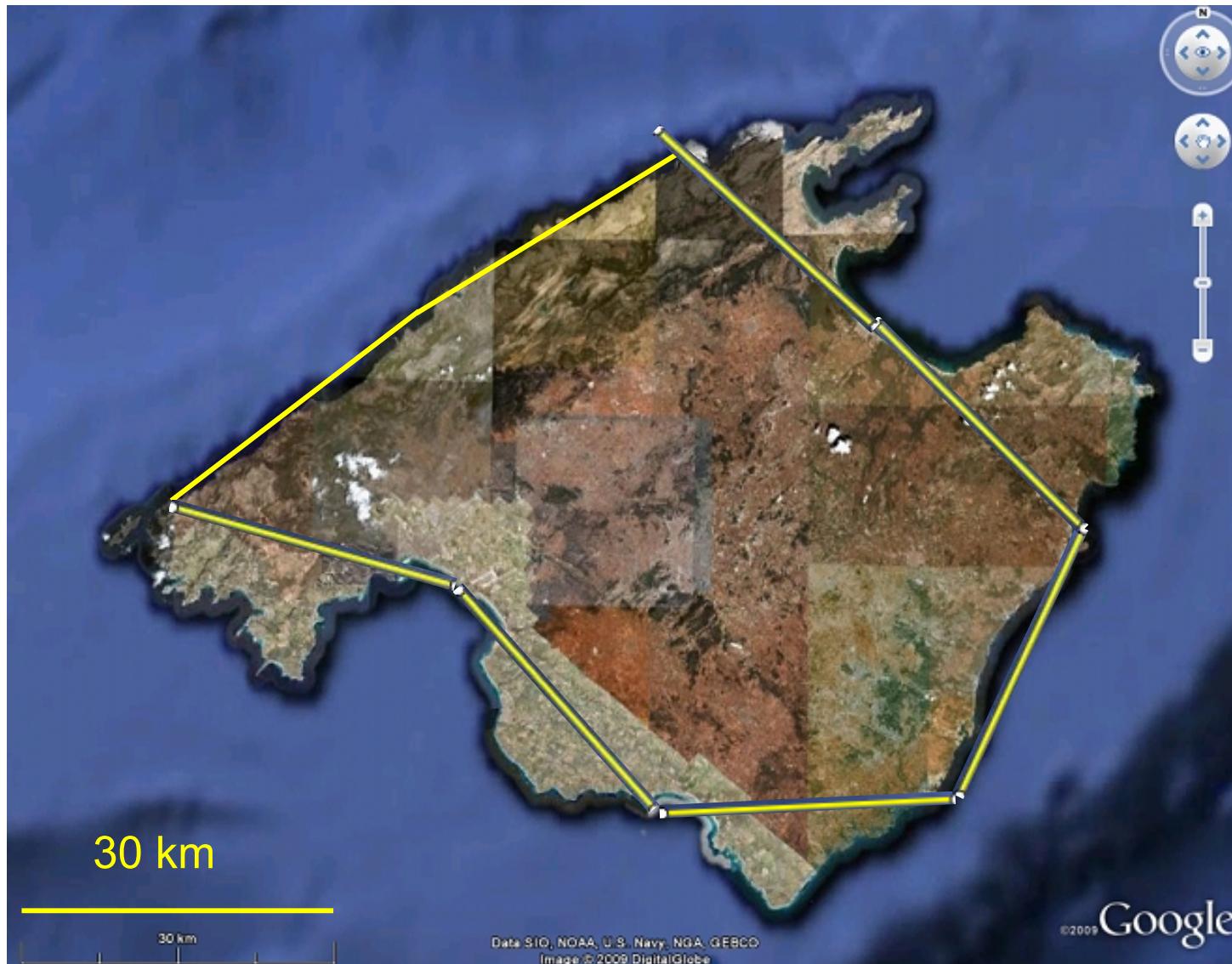


Longitud de la costa de Mallorca

http://www.mallorcatour.net/main/Mallorca_Overview/ :	550 km
http://mallorca-balears.com/mallorca/index-es.htm :	565 km
http://club.telepolis.com/geografo/regional/espa/balrel.htm	623 km
http://www.infomallorca.net/turismo/categorias/ficha.es.html?cc=180	623 km
http://Wolframalpha.com	407.8 km
Instituto Geográfico Nacional (1985):	416 km
Instituto Geográfico Nacional (2009):	606 km
Geografía de España (Planeta, 1992):	554.7 km
Gran Encyclopèdia de Catalunya (1976,1987):	416 km
Encyclopèdia de Mallorca (1989):	565 km
Gran Encyclopèdia de Catalunya (1995):	554 km
Gran Larousse Català (1992):	416 km

No apareix la dada a Larousse2000, Britannica, ni Espasa





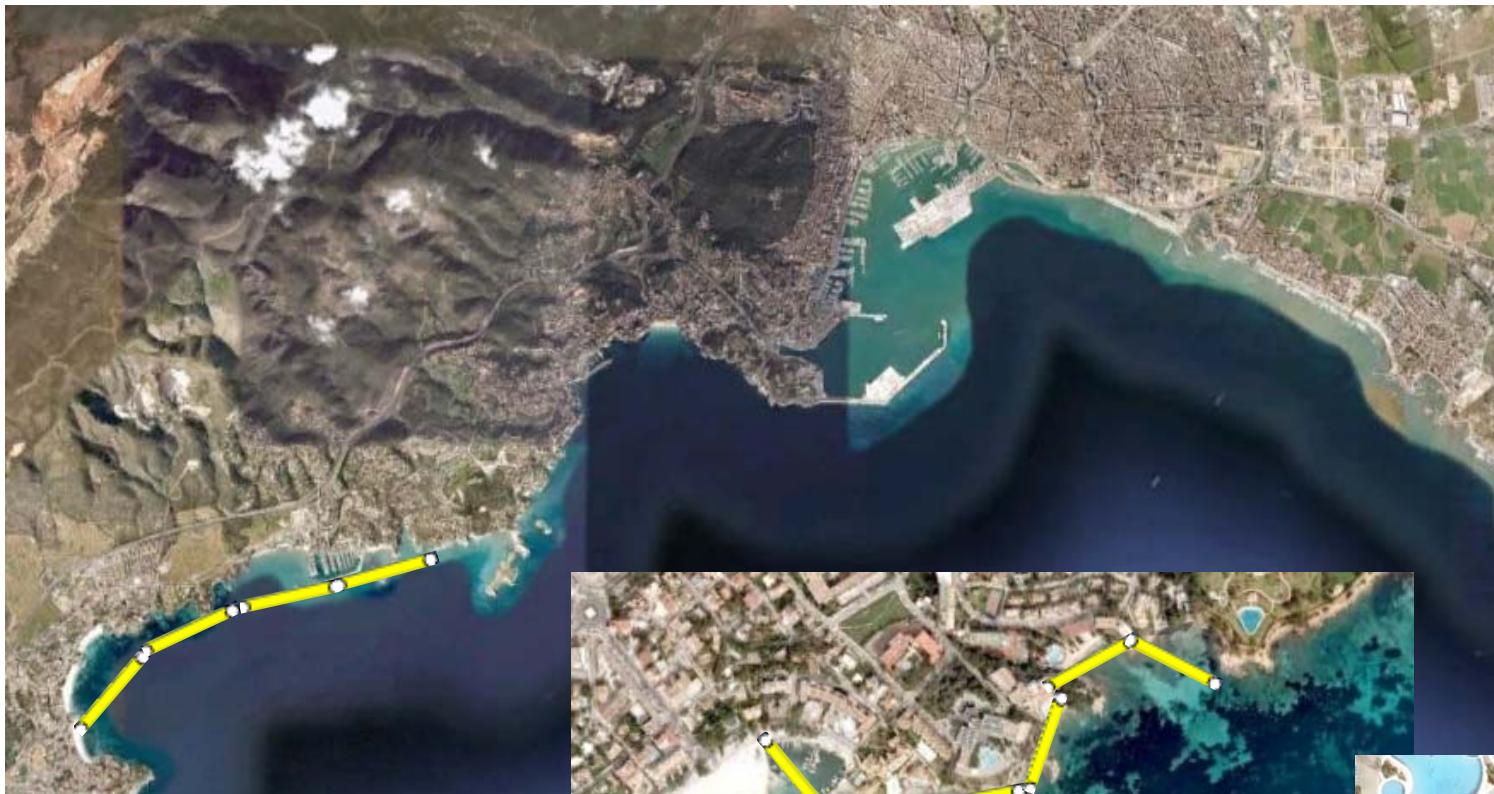
8 mides de 30 km

$$= 240 \text{ km}$$

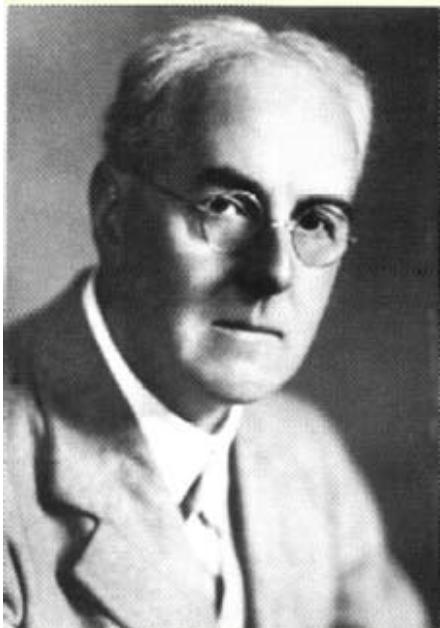


19 mides de
15 km
 $= 285 \text{ km}$



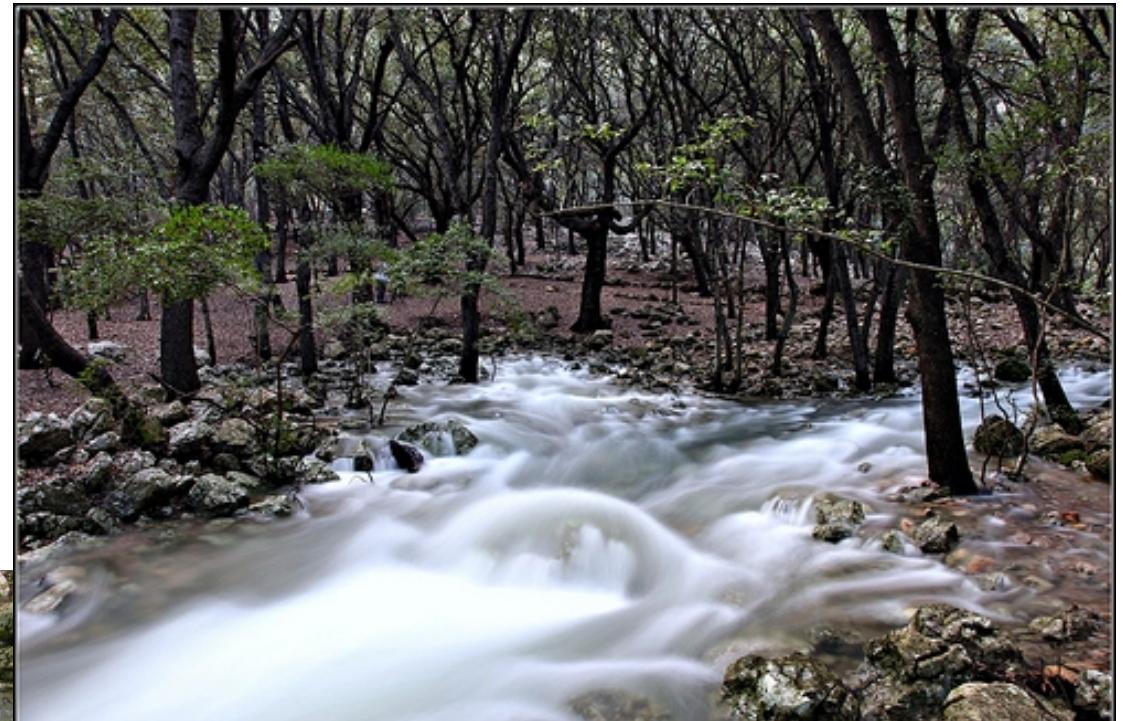


La costa de Mallorca, com les tires de pell del bou de n'Elissa, o les falgueres, és un fractal



Lewis Fry Richardson
(1881-1953)

*Big whirls have little whirls that feed
on their velocity,
and little whirls have lesser
whirls and so on to viscosity.*





Weather Prediction by Numerical Process (Predicció del temps per processos numèrics), 1922

"After so much hard reasoning, may one play with a fantasy? Imagine a large hall like a theatre, except that the circles and galleries go right round through the space usually occupied by the stage. The walls of this chamber are painted to form a map of the globe. The ceiling represents the north polar regions, England is in the gallery, the tropics in the upper circle, Australia on the dress circle and the Antarctic in the pit.

A myriad computers are at work upon the weather of the part of the map where each sits, but each computer attends only to one equation or part of an equation. The work of each region is coordinated by an official of higher rank. Numerous little "night signs" display the instantaneous values so that neighbouring computers can read them. Each number is thus displayed in three adjacent zones so as to maintain communication to the North and South on the map.

From the floor of the pit a tall pillar rises to half the height of the hall. It carries a large pulpit on its top. In this sits the man in charge of the whole theatre; he is surrounded by several assistants and messengers. One of his duties is to maintain a uniform speed of progress in all parts of the globe. In this respect he is like the conductor of an orchestra in which the instruments are slide-rules and calculating machines. But instead of waving a baton he turns a beam of rosy light upon any region that is running ahead of the rest, and a beam of blue light upon those who are behindhand.

Four senior clerks in the central pulpit are collecting the future weather as fast as it is being computed, and despatching it by pneumatic carrier to a quiet room. There it will be coded and telephoned to the radio transmitting station. Messengers carry piles of used computing forms down to a storehouse in the cellar.

In a neighbouring building there is a research department, where they invent improvements. But these is much experimenting on a small scale before any change is made in the complex routine of the computing theatre. In a basement an enthusiast is observing eddies in the liquid lining of a huge spinning bowl, but so far the arithmetic proves the better way. In another building are all the usual financial, correspondence and administrative offices. Outside are playing fields, houses, mountains and lakes, for it was thought that those who compute the weather should breathe of it freely." (Richardson 1922)



Weather Prediction by Numerical Process (Predicció del temps per processos numèrics), 1922

Una mirada de computadores treballen sobre el temps de la part del mapa a on està. Pero cada computadora només considera una de les equacions o una part. ... Moltes senyals lluminoses indiquen els valors instantanis de tal manera que les computadores properes poden llegirles.

"Imagineu una habitació gran com un teatre ... Les parets estan pintades formant el mapa de la Terra painted to form a map or the globe. The ceiling represents the north polar regions, England is in the gallery, the tropics in the upper circle, Australia on the dress circle and the Antarctic in the pit. A myriad computers are at work upon the weather of the part of the map where each sits, but each computer attends only to one equation or part of an equation. The work of each region is coordinated by an official of higher rank.

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us displayed in three adjacent zones so as to maintain communication to the North

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Quatre oficials sèniors recullen el temps futur tan aviat com es calcula ... Missatgers porten piles de computacions al magatzem



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Four senior clerks are despatching it to the transmitting station. In a neighbouring basement an engineer is experimenting to improve the better. Outside are planes which should breathe



National Weather Research Center E49-0053 Photographed 10/49
Early "computers" at work. NASA photo



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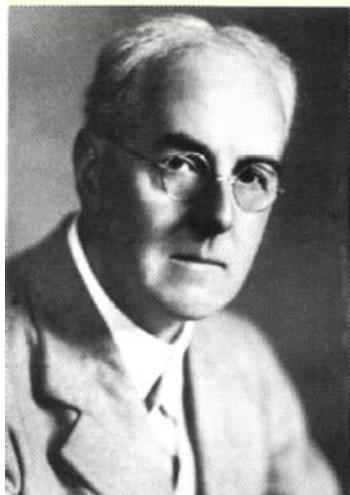
National Weather Research Center E49-0053 Photographed 10/49
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Richardson va ser pioner en modelar conflictes i guerres amb equacions diferencials i probabilitats.

Arms and Insecurity (1949), and *Statistics of Deadly Quarrels* (1950)

hipòtesi: "La probabilitat de guerra entre dos països es proporcional a la longitud de la seva frontera"

Va notar grans diferències entre aquestes longituds segons
la font: Portugal-Espanya: 987 - 1214 km .
Holanda-Bèlgica: 380 - 449 km.

Lewis F. Richardson (1961). "The problem of contiguity: An appendix to Statistic of Deadly Quarrels" :

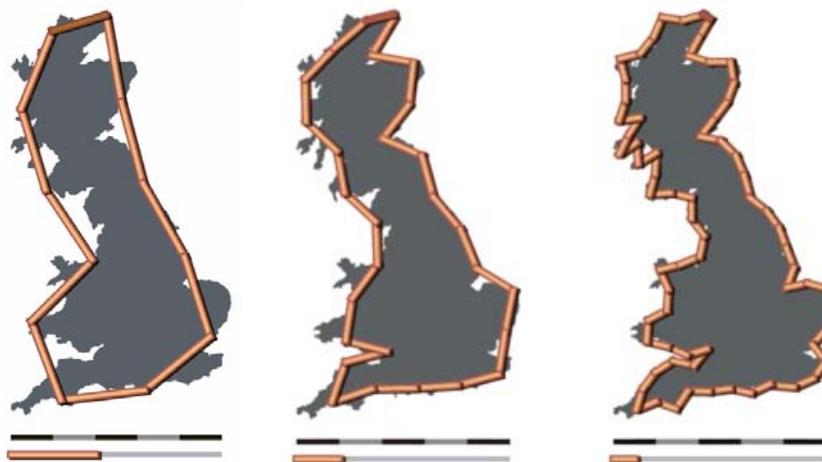
"Some strange features came to notice; nevertheless an over-all general correction was found possible. The results will now be reported. ... As an explanation of how chance can arise in a world which he regarded as strictly deterministic, Henri Poincaré drew attention to insignificant causes which produced very noticeable effects. Seacosts provide an apt illustration.".

Com una explicació de com l'atzar pot donar-se en un món que ell considerava estrictament determinista , Henri Poincaré va cridar l'atenció a causes insignificants que produeixen efectes molt notables. Les costes en són una il·lustració molt adient.



Benoît Mandelbrot, 1924

*Science 5 May 1967: How Long Is the Coast of Britain?
Statistical Self-Similarity and Fractional Dimension*



Les costes poden considerar-se objectes (FRACTALS) d'una dimensió entre 1 i 2. Tenen una longitud L que depén de la escala de mida G:

$$L(G) = M G^{1-D}$$

Per Mallorca,

$G=30 \text{ km} \rightarrow L= 240 \text{ km}$
$G=15 \text{ km} \rightarrow L= 285 \text{ km}$
$G=7.5 \text{ km} \rightarrow L= 315 \text{ km}$

D ≈ 1.12

Per Gran Bretanya: D ≈ 1.25

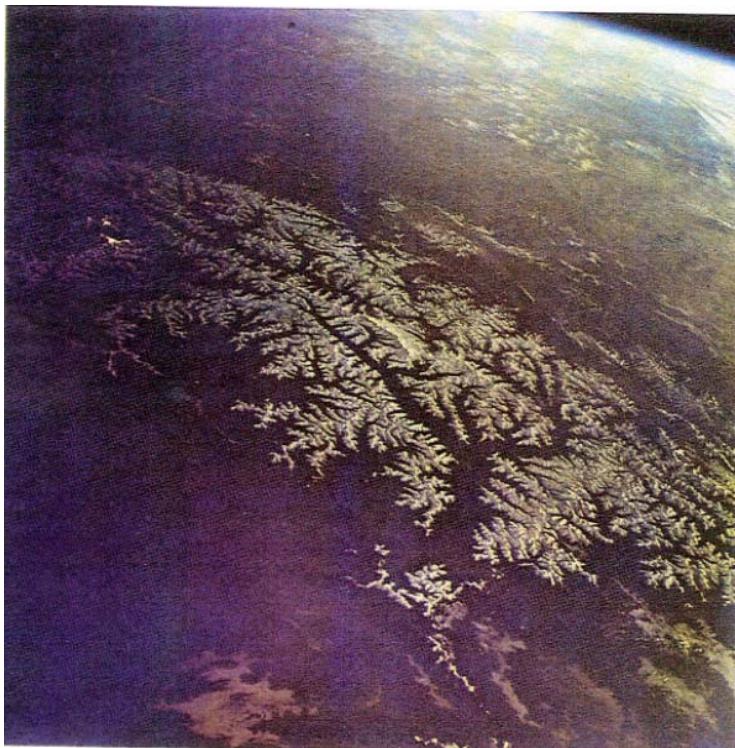


Plate 14: Dawn over the Himalayas, Gemini IV image, © Dr. Vehrenberg KG.

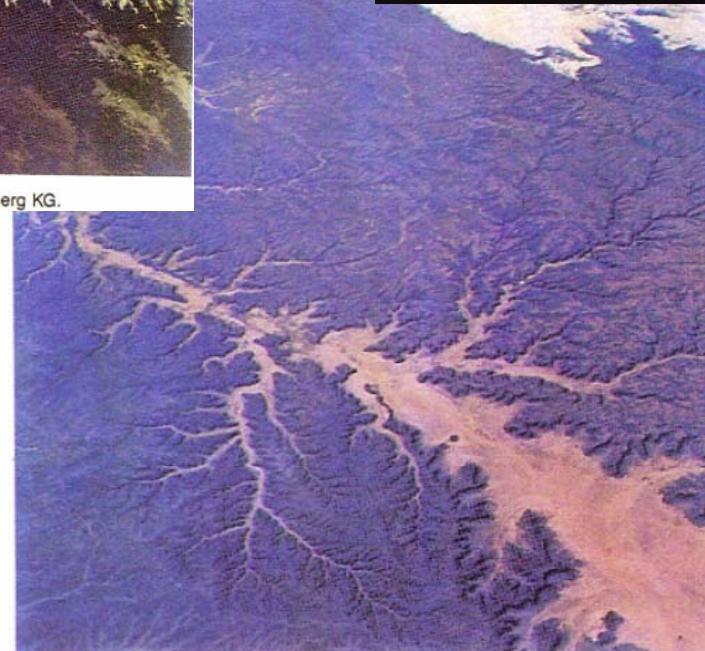


Plate 4: Wadi Hadramaut, Gemini IV image, © Dr. Vehrenberg KG.

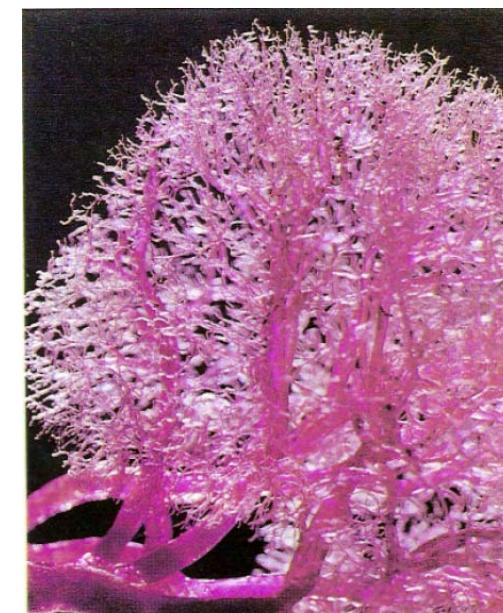


Plate 2: Cast of a child's kidney, venous and arterial system,
© Manfred Kage, Institut für wissenschaftliche Fotografie.



Plate 10: "Zabriski Point", fractal forgery of a mirage, © K. Musgrave, C. Kolb, B.B. Mandelbrot.

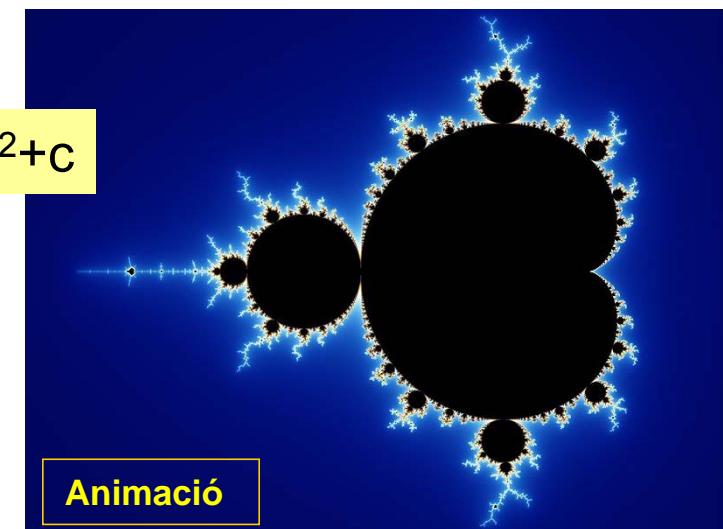


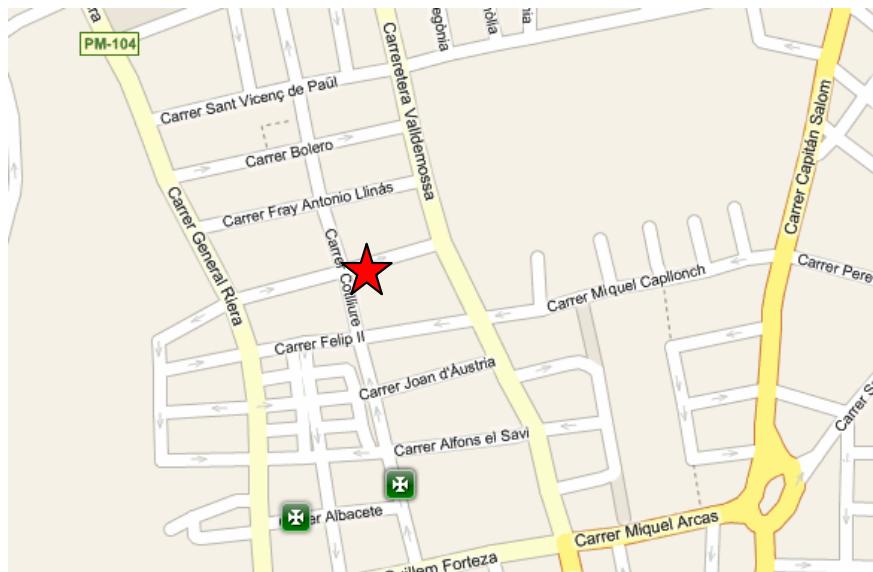
Plate 6: Fractal forgery of a mountain range with Mandelbrot sky, © R.F. Voss.



Plate 11: "Carolina", fractal forgery, © K. Musgrave.

$$f(z) = z^2 + c$$





Sant Josep de la Muntanya - Cotlliure



Depósito Ocasión

BBVA

endavant,
emporta't de regal 18 copes
de Villeroy & Boch
en obrir un Depósito Ocasión



Depósito Ocasión

BBVA

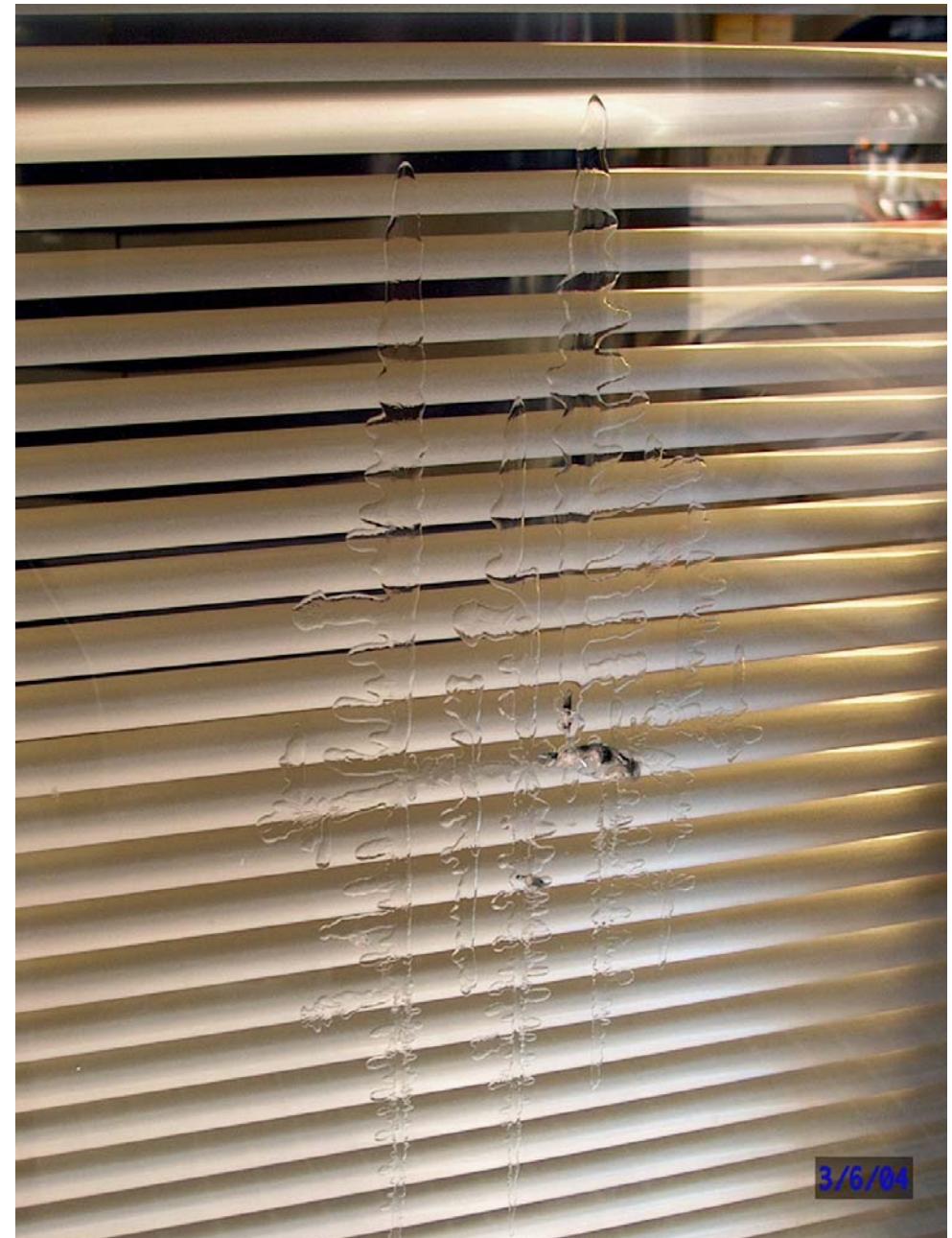
adelante.
llévate de regalo 18 copas
de Villeroy & Boch
al abrir un Depósito Ocasión.



ALQUILAMOS
APARTAMENTOS
* 626 783 141



3/6/04







3/6/04



3/6/04



BBVA

3/6/04





16/6/04

JEFATURA PROVINCIAL DE TRAFICO
MINISTERIO DEL INTERIOR



26/10/04



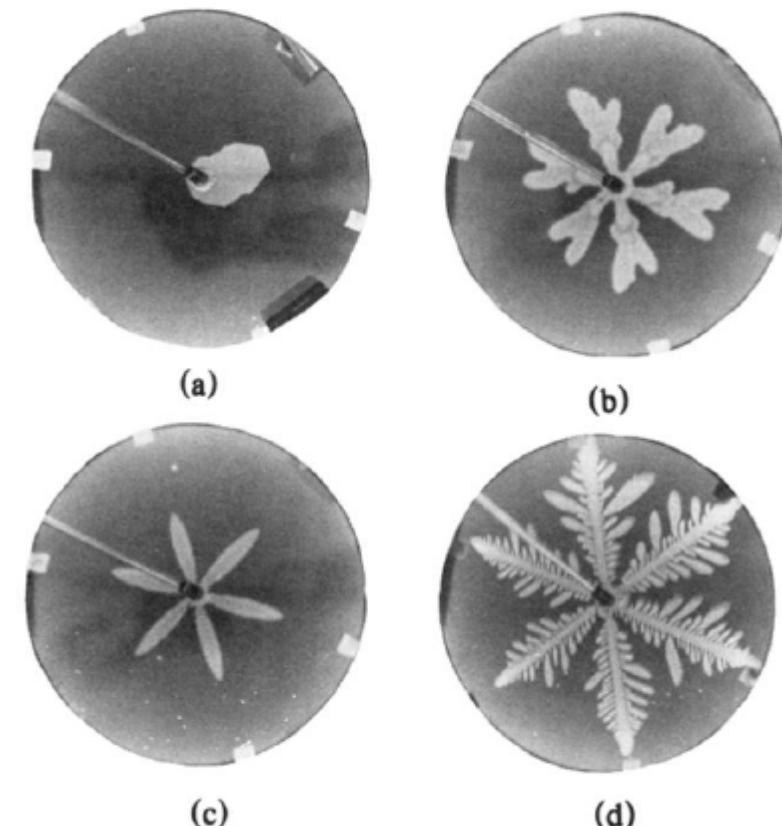
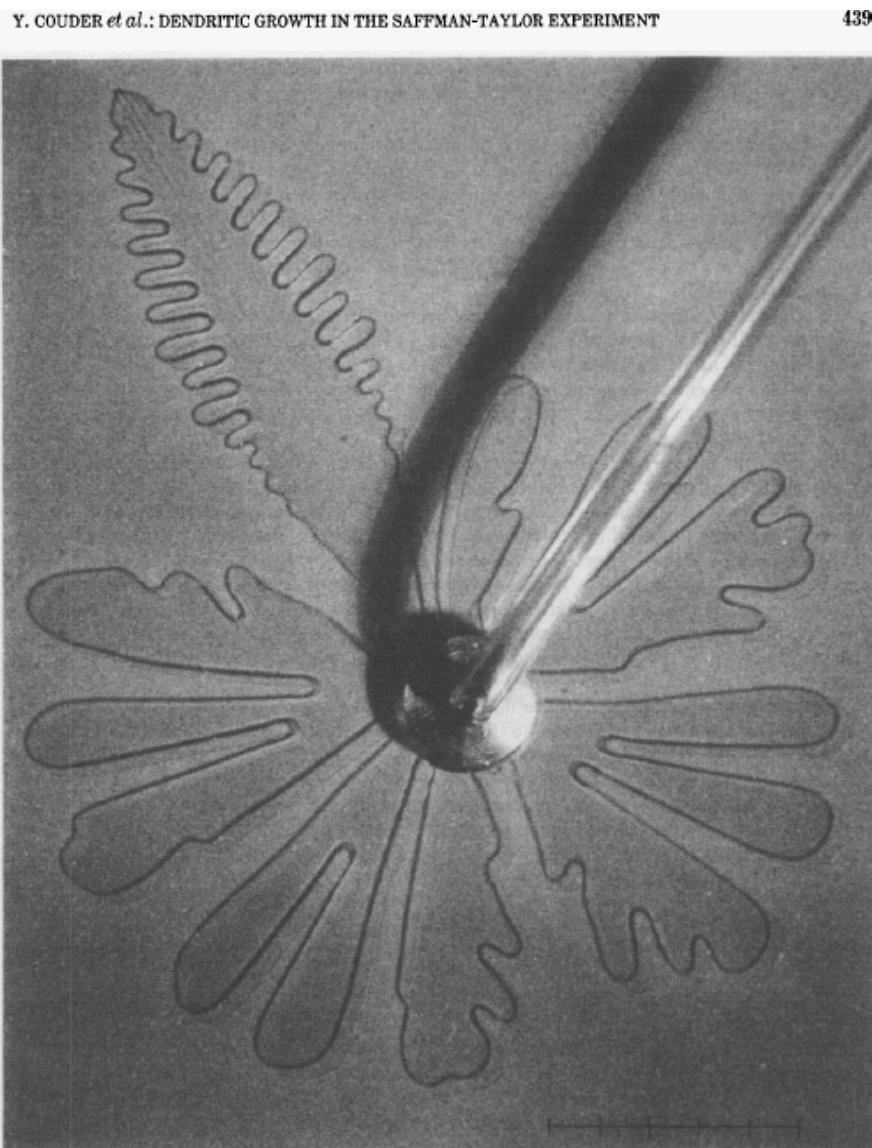
26/10/04



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Couder et al, 1985

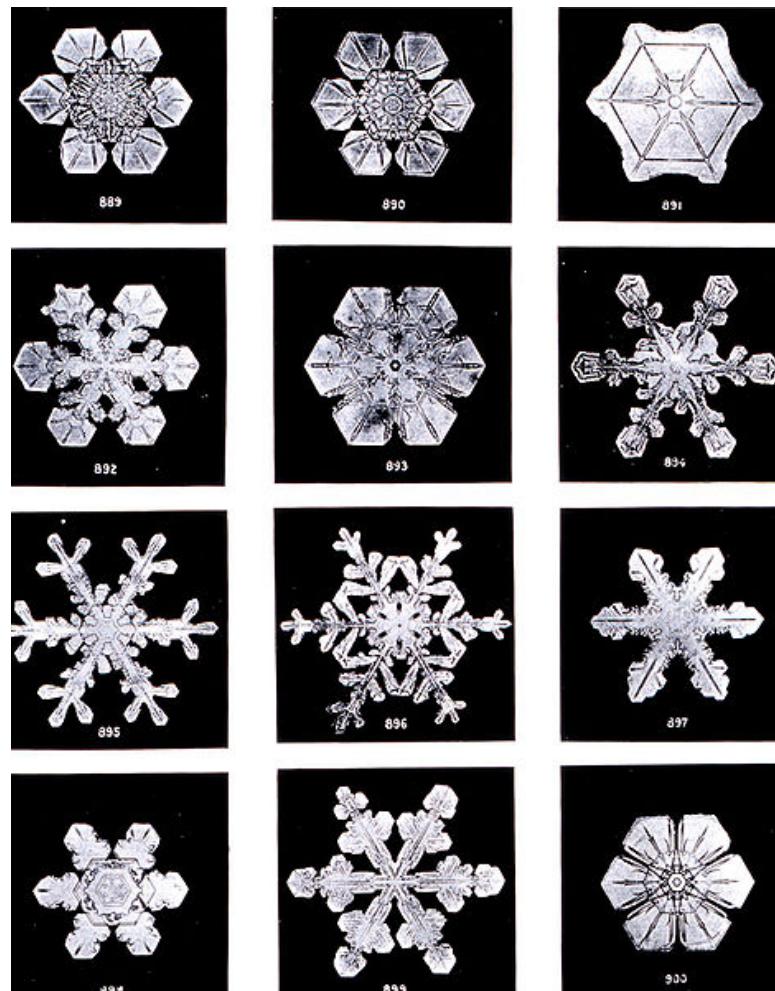


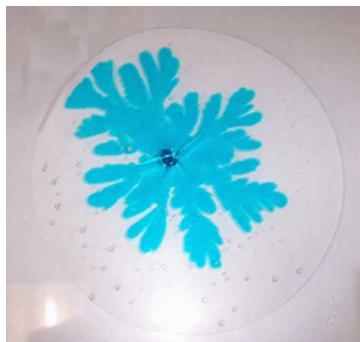
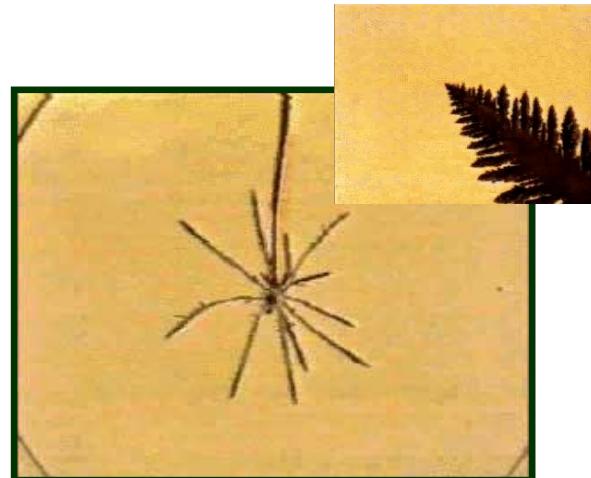
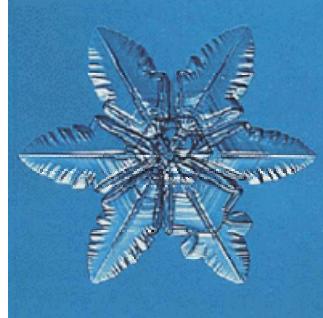
Ben-Jacob et al, 1985

La fascinació per les formes de la Natura

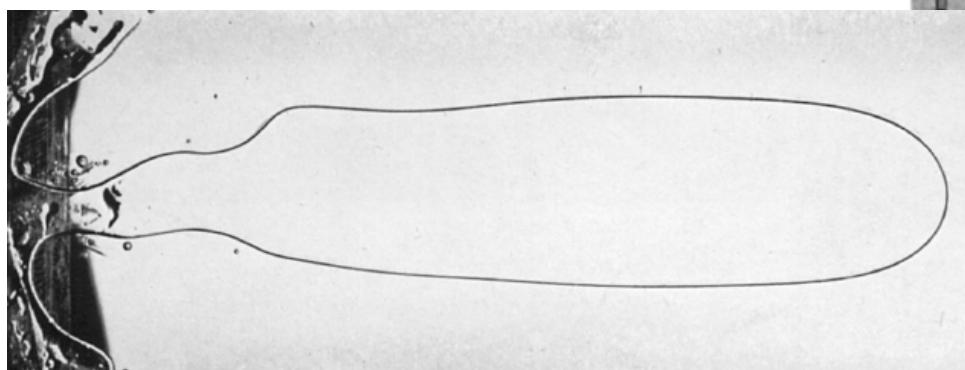


“Under the microscope, I found that snowflakes were miracles of beauty; and it seemed a shame that this beauty should not be seen and appreciated by others. Every crystal was a masterpiece of design and no one design was ever repeated. When a snowflake melted, that design was forever lost. Just that much beauty was gone, without leaving any record behind.”
Wilson A. Bentley





Existeix un patró de creixement comú ?



Philip Geoffrey Saffman
(1931 – 2008)

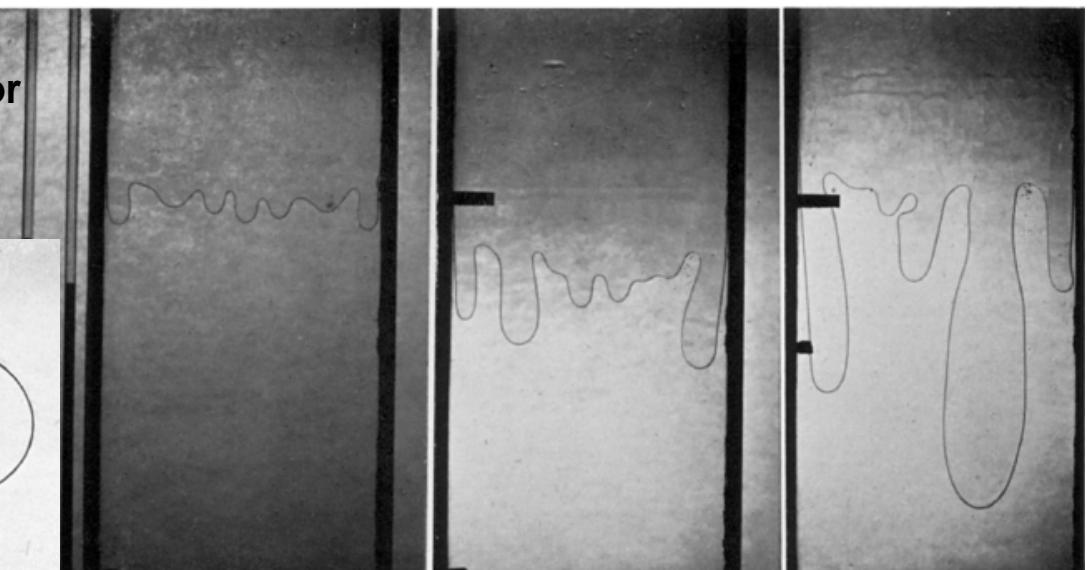
**Sir
Geoffrey Ingram Taylor**
(1886 – 1975)

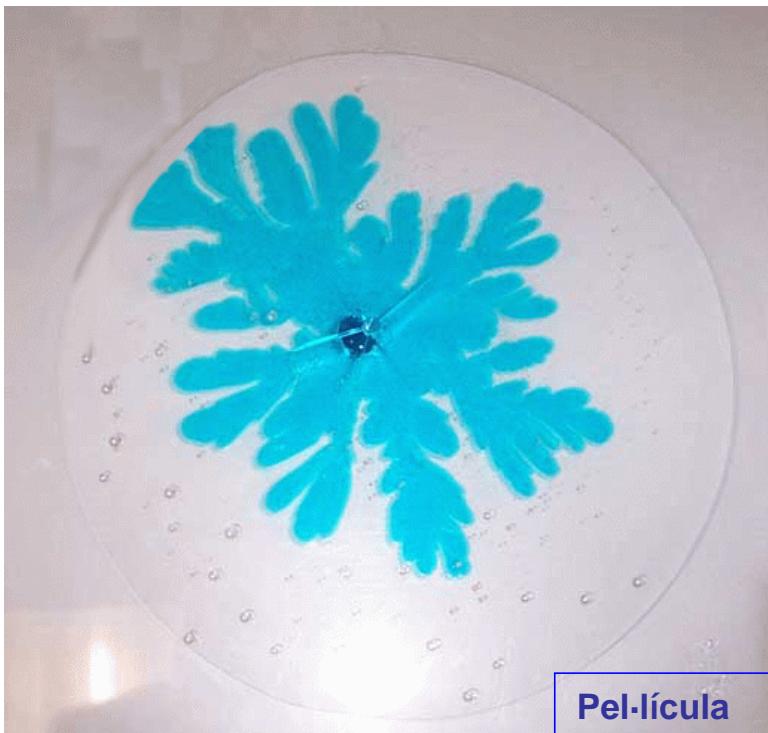
The penetration of a fluid into a porous medium
or Hele-Shaw cell containing a more
viscous liquid

By P. G. SAFFMAN AND SIR GEOFFREY TAYLOR, F.R.S.

Cavendish Laboratory, University of Cambridge

(Received 17 January 1958—Read 17 April 1958)

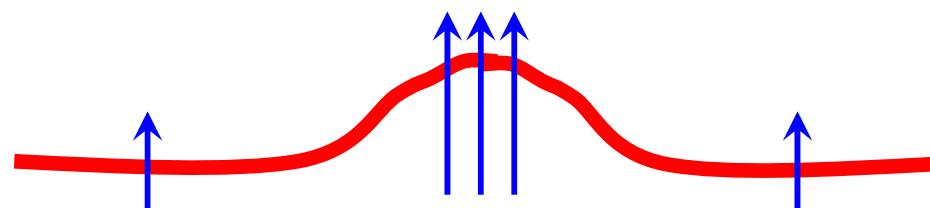


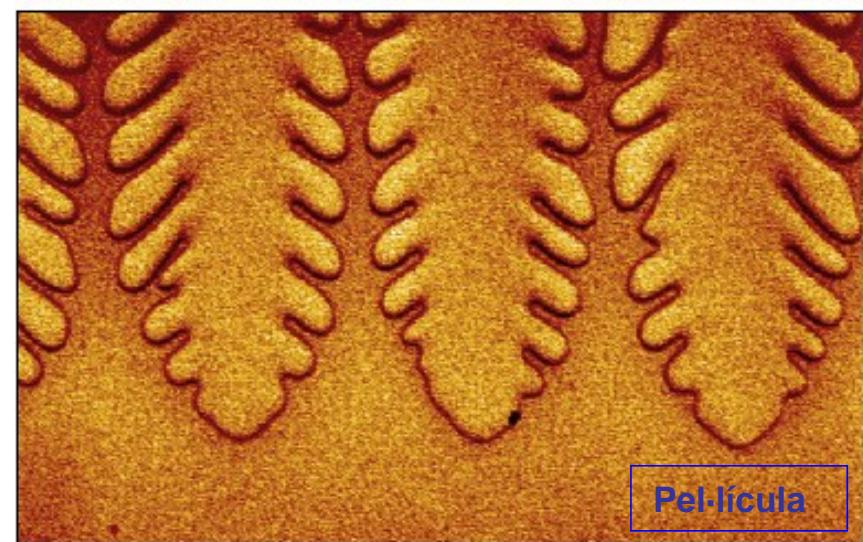
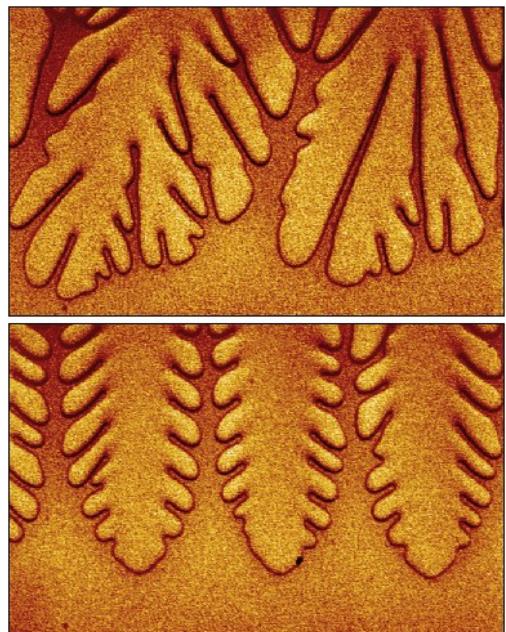
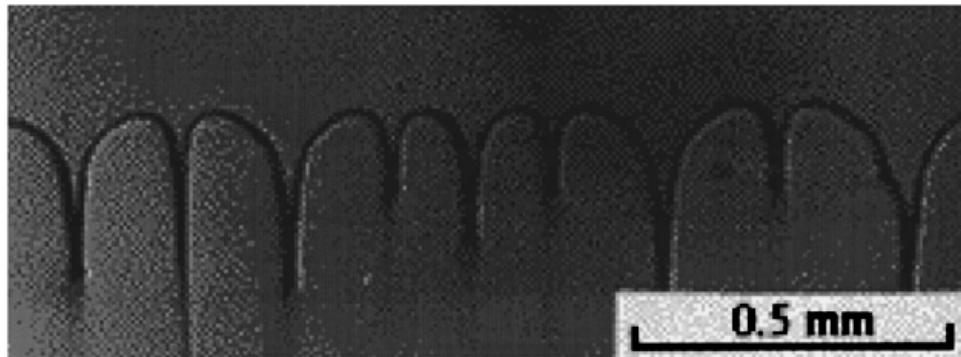


Aigua penetrant en glicerina

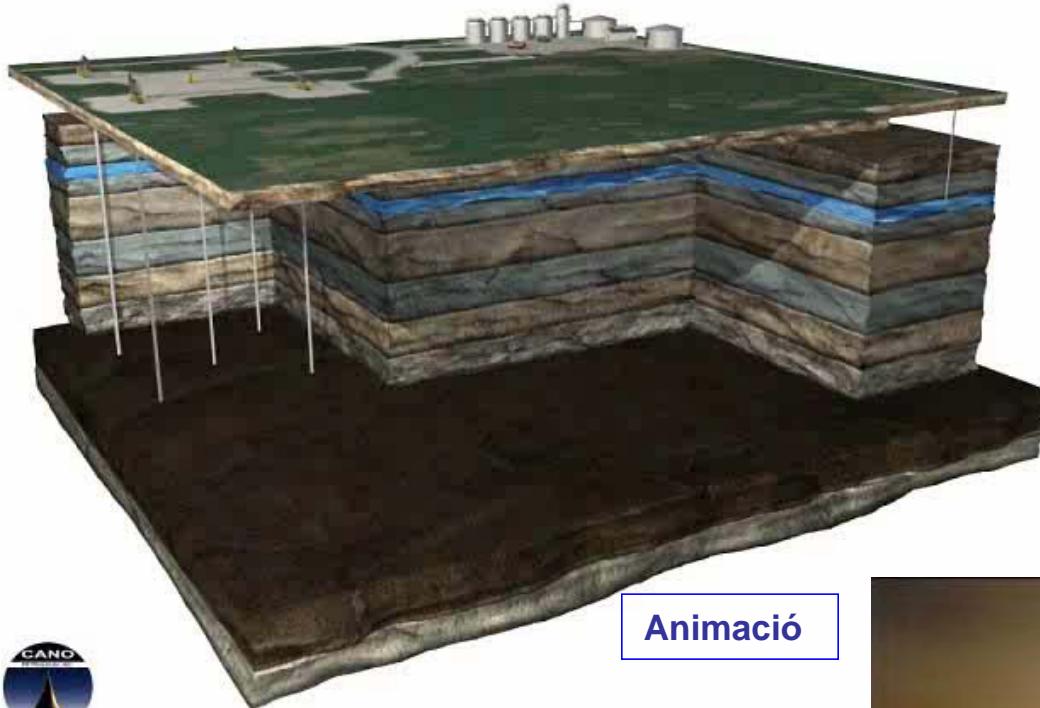


Efecte puntes: la velocitat de creixement es més gran a les zones en punta





Solidificació direccional: MULLINS-SEKERKA instability



Animació



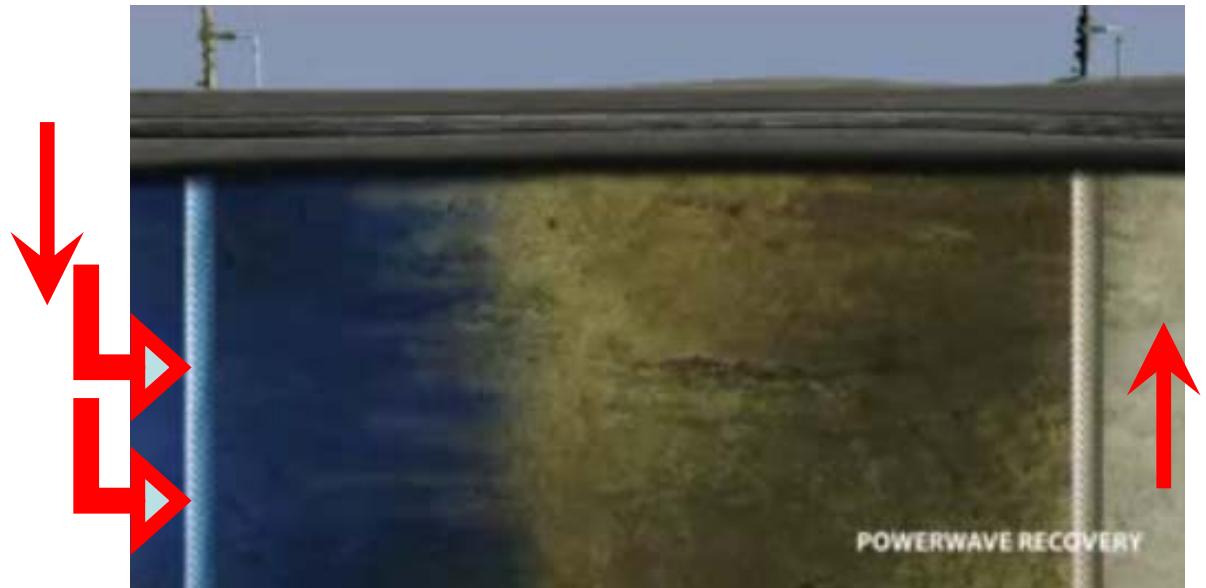
EXTRACCIÓ SECUNDÀRIA DE PETROLI





Animació

Aditius (polimers ...)
bombeig polsat ...



The search for differences or fundamental contrasts between the phenomena of organic and inorganic, of animate and inanimate things, has occupied many men's minds, while the search for community of principles or essential similitudes has been pursued by few;

But the physicist proclaims aloud that the physical phenomena which meet us by the way have their forms not less beautiful and scarce less varied than those which move us to admiration among living things. The waves of the sea, the little ripples on the shore, the sweeping curve of the sandy bay between the headlands, the outline of the hills, the shape of the clouds, all these are so many riddles of form, so many problems of morphology, and all of them the physicist can more or less easily read and adequately solve:

d'Arcy W. Thompson, On growth and Form, 1917

La cerca de diferències o contrastos fonamentals entre els fenòmens orgànics o inorgànics, en les coses animades i inanimades, ha ocupat la ment de molts homes, mentre que la cerca de principis comuns o similituds essencials l'han seguit pocs.

Però el físic proclama fort que els fenòmens físics que ens trobem pel camí tenen formes no menys belles i gairebé no menys variades que les que ens mouen a admirar les coses活ives. Les ones de l'oceà, les ondulacions de la platja, la corba captivadora de la badia arenosa entre promontoris, la silueta dels turons, la forma dels núvols, tot això representa tal varietat de formes, tant de problemes en morfologia, i el físic pot més o manco fàcilment llegir-les i resoldre-les.



Andrew Davidhazy