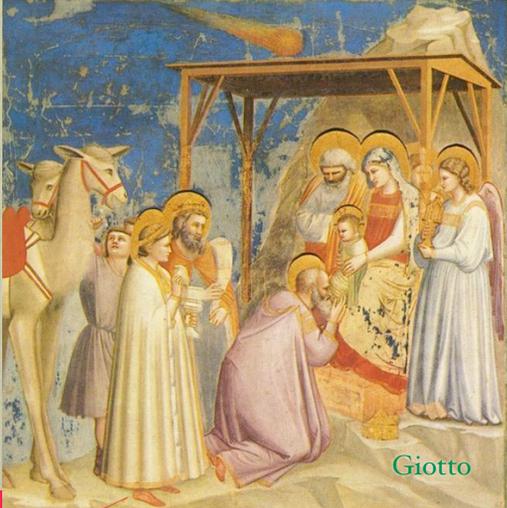


Star of Wonder, Star of Light



The Bible as History: Exodus.

- *First Plague:.....He raised his staff and struck the waters of the Nile and all the water was changed into blood*
- *By day the Lord went before them in a pillar of cloud....and by night in a column of fire*
- *..the waters were divided and the Israelites went though the sea on dry land*
- *...at daybreak the sea went back to its place*

Peter Watson

Pillar of cloud by day,

- Mt St Helens



A column of fire by night

- Volcanoes provide rapid up-drafts + lots of friction between particles so...



Parting of the Red Sea

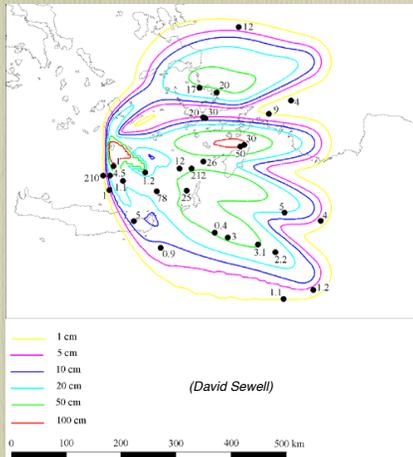
Tsunami first drains Red Sea and then drowns Pharaoh's army



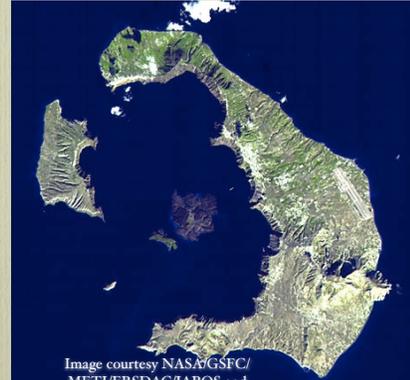
- Eruption of Mt. Thera on Santorini
- First explosion on scale of Mt. St. Helen, deposited ash over the eastern Mediterranean



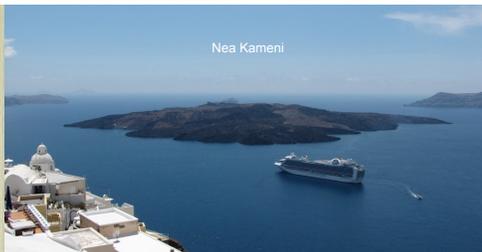
One of largest eruptions in last few millennia,
~1600 BC



- Followed ~ 20 years later by a “paroxysmal eruption” which produced catastrophic tsunamis.
- Destroyed the Minoan civilization on Crete: (Knossos is 120 km away).



- Brian Cousens



- Atlantis: a land of great natural wealth and advanced civilization that sank beneath the waves in a single day and night of misfortune.
- Plato gave Atlantis dimensions of 200 kilometres by 400; pre-eruption Santorini was about 20 x 40.
- Huge cloud of dust from Santorini had worldwide effects, extending as far as China,
- Shang dynasty began with darkness ~1600 B.C.

But to be honest...

- The details don't really fit together in a simple way
- e.g. Thera would be in North from Egypt
- Israelites would have crossed Red Sea from West to East

Matthew 2

- *Magi from the east came to Jerusalem and asked “Where is the one who has been born King of the Jews? We saw his star in the East..”*
- *...they went on their way and the star they had seen in the east went ahead of them until it stopped over the place where the child was...*

Historically Comets have fascinated us

CALPURNIA: When beggars die, there are no comets seen;
The heavens themselves blaze forth the death of princes.

Julius Caesar

Comets are like cats: they have tails and do what the hell they like

Anon



Peter Watson

- Great comet of 1577, over Prague (Daschitzky)
- Noted by Tycho Brahe as being further than the moon



Peter Watson

- “Ghost of a Flea” (William Blake) supposedly shows great comet of 1811



Peter Watson

- Donati's comet (1858)
- produced exceptionally fine vintage of claret



Peter Watson

What are they?



Comet Mcnaught, from the Herzberg Building at Carleton (Etienne Rollin)



Peter Watson

This is McNaught

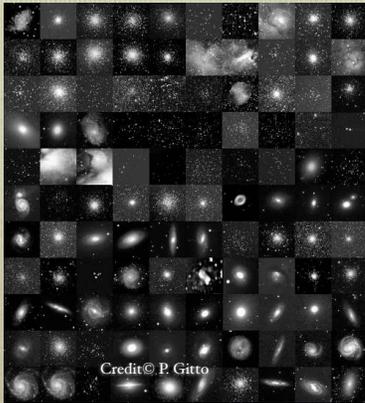
Notice all the tails

Comets are named after their discoverers



Peter Watson

The man who loved comets: Messier (pr Messié)



Gave us a list of objects that aren't comets!

So don't look at them

Credit © P. Gitto

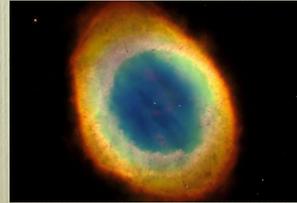
Peter Watson



M1 = Crab nebula



M31 = Andromeda galaxy



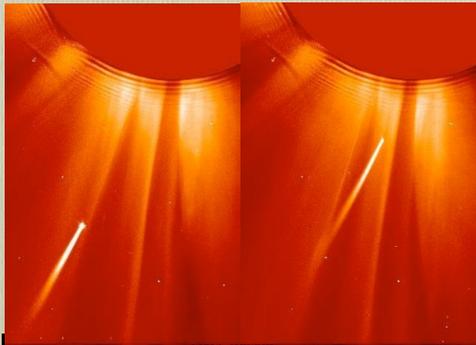
M57 = Ring nebula

Unfortunately they are the most interesting objects in the sky!

Peter Watson

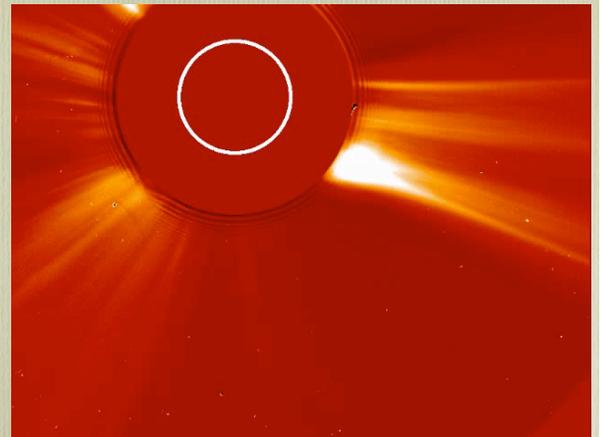
So who found the most comets?

- SOHO! (Solar and Heliospheric Observatory) found 2000th comet in 2010!
- And we learned that most comets are never seen!
- "Sungrazers"



Peter Watson

- A double play!



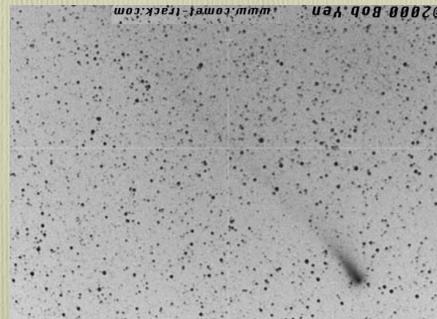
Peter Watson

- So what are they?
- "Dirty Snowballs" water + dust + gas
- Water boiling causes breakup
- Some comets observed to have jets, which can alter orbits
- this is Mrkos



Peter Watson

- This is comet LINEAR,



Bob Yen

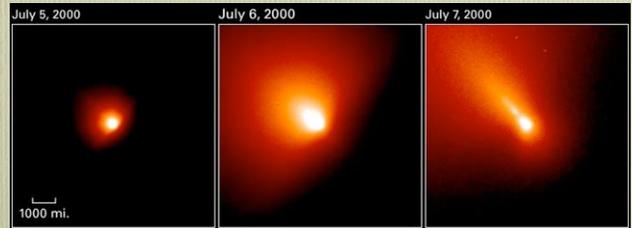
Peter Watson

- which was going to be quite spectacular



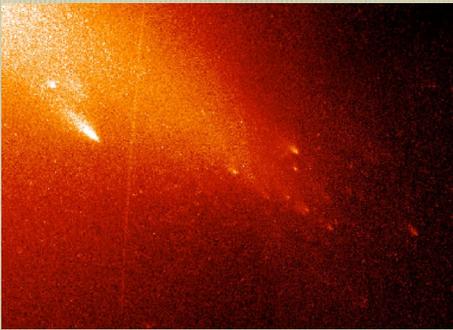
Peter Watson

- However it didn't work out that way!
- It split in two



Peter Watson

- Then it shattered into pieces!



Peter Watson

- and more pieces



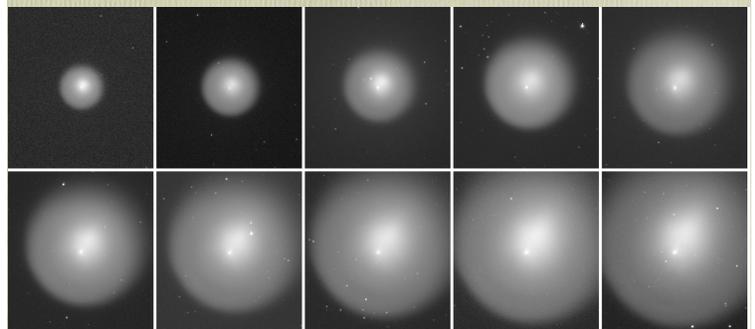
Peter Watson

- and finally just evaporated!



Peter Watson

- and sometimes they blow up in odd ways:
this is Holmes
- easily visible with naked eye



1E+04 3E+04

Peter Watson

Ganymede

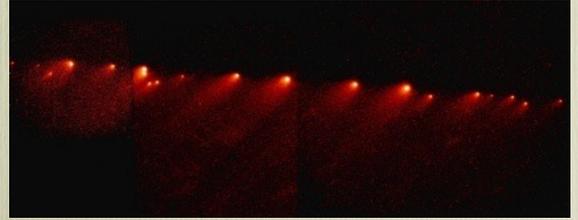
- Chain of craters:
- maybe made by a comet hitting



Peter Watson

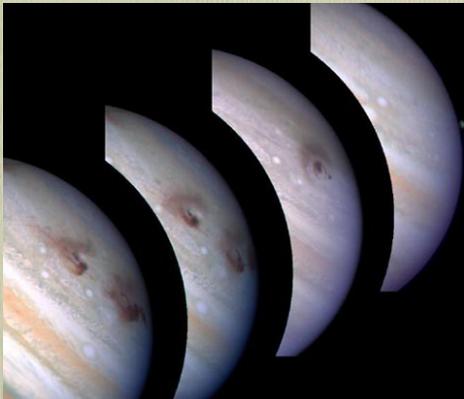
Probably produced by breakup of comet by Saturn

- Like Shumacher-Levy



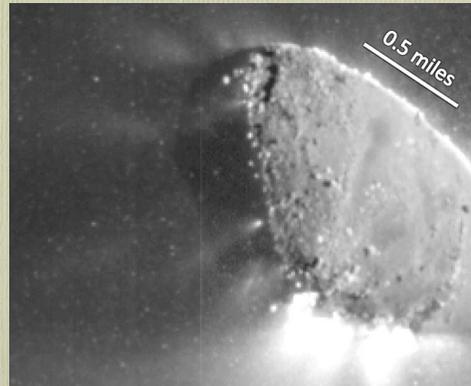
Peter Watson

Which collided with Jupiter



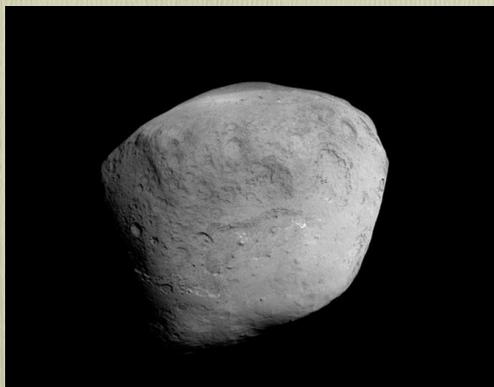
Peter Watson

- Can actually watch them blowing apart: this is core of Hartley



Peter Watson

Close-up of Tempel 1 (Imaged by NeXT)

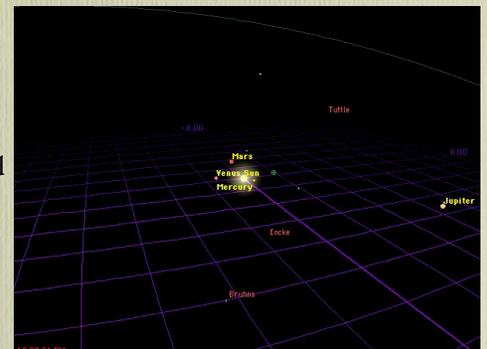


Peter Watson

So where do they come from?

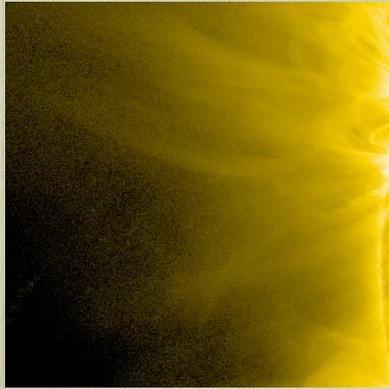
- A long way out: these are the comets of 1858

Implies huge cloud of comets beyond planets



Peter Watson

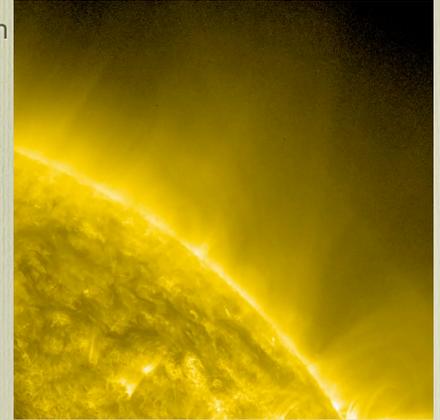
Another comet that wasn't going to make it: comet Lovejoy



Peter Watson

Except it did!

- less than 1 million km from sun



Peter Watson

And it was quite spectacular!

- Image Credit: Left - [Carlos Caccia](#), (Intendente Alvear, Argentina) / Right - Dan Burbank ([ISS Expedition 30](#), NASA)



Peter Watson

The discoverer of Haley's comet

- Bill Haley and the Comets singing their greatest hit
- "Rock Around the Sun"



Well, no actually...

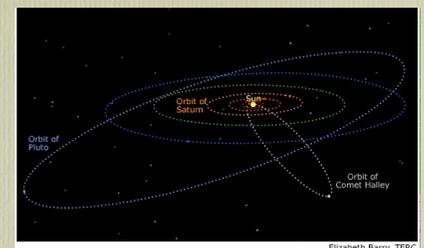
Peter Watson

Edmund Halley

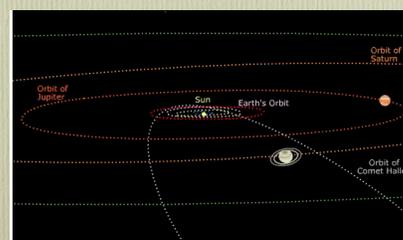
- comet which had appeared in 1682,
- had appeared in 1531 (observed by [Petrus Apianus](#))
- and 1607 (observed by [Johannes Kepler](#)).
- he predicted its return for 1758

Peter Watson

i.e comets work the same way as planets!



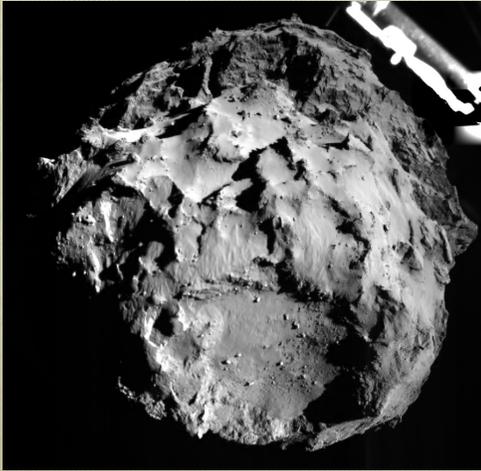
Elizabeth Barry, TERC



Elizabeth Barry, TERC

Peter Watson

Comet 67P/Churyumov-Gerasimenko



ESA Rosetta

Where did the water on Earth come from?

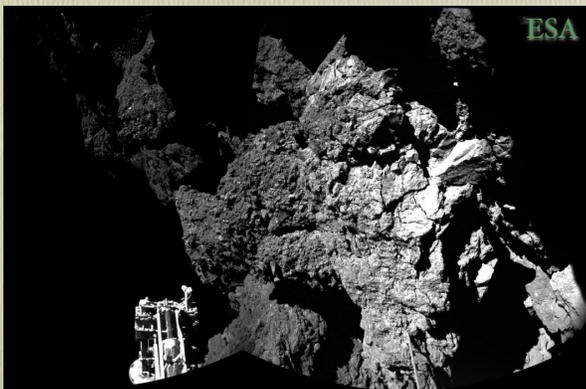
- Originally Earth would have been too hot to support liquid water...
- so maybe it arrived as part of the bombardment of comets.
- but the water on 67P is different from that on earth: too much deuterium (heavy hydrogen)

We may be star-dust, we are not comet-water!

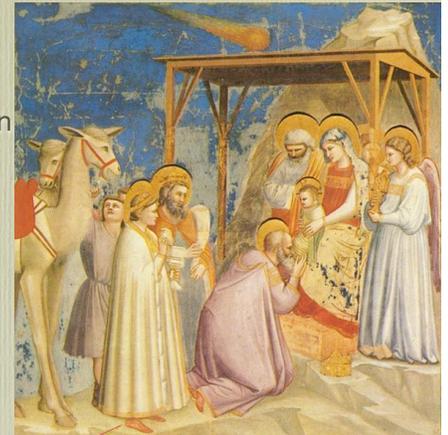


Peter Watson

Wake me up in 2015....



- Giotto "Adoration of the Magi" ~1320 AD
- Saw Halley's comet in 1301 AD
- Would have been visible in 12 BC, (but Giotto couldn't have know it!)



Peter Watson

would have been at its
brightest 10 October 12 BC

Too early

Any other options?

In 7-6 BC

Jupiter and Saturn were close in the sky,
followed by Mars, Jupiter and Saturn coming
together in Pisces

Great Astrological
Significance



Peter Watson

And

Chinese recorded a comet

6 April 5 BC

Visible for over 70 days

Moved south, so would have been seen in the East from Babylon and then moved over Israel

Magi would have taken 1-2 months for the journey

Colin Humphreys: <http://www.asa3.org/ASA/topics/Astronomy-Cosmology/S&CB%2010-03/Humphreys.html>



Peter Watson

Or

- It could have been a conjunction of Jupiter and Venus (June 17, 2BC)



Or

it could have been a supernova



Peter Watson

The Oxen (Thomas Hardy)

*Christmas Eve and twelve of the clock
Now they are all on their knees
An elder said, as we sat in a flock,
By the embers, in hearth-side ease.
We pictured the great dark creatures
As they dwelt in their strawy den;
Nor did it occur to one of us there
To doubt they were kneeling then.*

*So fair a fancy, few would weave
In these years, yet I feel
If someone said on Christmas Eve
"Come see the oxen kneel"
In the lonely barton by yonder coomb
Our childhood used to know
I should go with him through the gloom,
Hoping it might be so*



Peter Watson

Matters arising..

- How far is the horizon/how far can we see Mauna Kea from?

- h in feet, d in miles $d = \sqrt{1.52h}$

- h in metres, d in km $d = \sqrt{13h}$

- so Mauna Kea (14000 ft) should be visible from 235 km or 145 miles

- horizon from Crow's Nest ~ 12 miles ~ 20 km



Peter Watson

- Astronomy Picture of the Day (APOD)
- ESA (European Space Agency)
- NASA
- Hubble Space Telescope
- and tomorrow "A Star is Born"



Peter Watson

Hawaii!

Summit of Mauna Kea has 13 major telescopes



Peter Watson

Can we see the Southern Cross

- Yes: best time is 3 a.m., 15° above the horizon!
- Wait two days!

