

# Presentation: Can we calculate palaeogravity?

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## Presentation abstract

Palaeogravity, the strength of the Earth's surface gravity in the past, is widely assumed to have been constant for a vast amount of geological time. I outline a simple scientific method to check if this belief is correct.

Measuring the Earth's surface gravity today (1g) is a simple scientific procedure. Only two measurements are required: weight and mass. Palaeogravity can therefore be calculated by calculating the weight of a mass that existed in the past. An extinct animal can be used to calculate palaeogravity using the weight-mass method if both its weight and mass are known.

Palaeogravity can be calculated from:

$$g_a = w_a / m$$

where  $g_a$  is palaeogravity at some predefined age,  $w_a$  is the weight at that age and  $m$  is the mass. Since mass never varies it does not need a subscript to denote its age.

**For weight:** the weight of extant land-based animals can be compared to the dimensions of their leg bones to derive a formula for weight based on leg bone dimensions. This formula can also be used to calculate the weight of extinct land-based animals. **For mass:** palaeontologists have produced accurate reconstructions of a large number of extinct animals. These reconstructions allow the mass of land-based animals to be calculated from their body volumes and tissue density.

The weight-mass technique can be used to calculate palaeogravity for a range of time periods based on a number of animals. *Coelophysis* predicts 0.42g and 0.44g at 210 million years ago (Ma), *Megalosaurus*: 0.51g at 167 Ma, *Giraffatitan*: 0.54g at 152 Ma, *Acrocanthosaurus*: 0.54g at 113 Ma, *Gigantoraptor*: 0.61g at 80 Ma, *Euoplocephalus*: 0.65g at 76 Ma, *Tyrannosaurus rex*: 0.67g, 0.66g, 0.61g, and 0.64g at 67 Ma, *Ankylosaurus*: 0.69g at 67Ma and *Paraceratherium*: 0.73g, 0.81g and 0.85g at 29 Ma. These calculations can be examined in more detail at <https://dinox.org/pub>.

The results indicate that, far from being the constant assumed, the Earth's surface gravity was substantially less in the past and has slowly increased towards our present day surface gravity.

**N.B. This presentation was prepared for the Polish Geological Congress due to be held from 16 - 18 June 2020 at Poznań. Since the Coronavirus Pandemic means it will not now be presented at the congress I have placed a YouTube version at:**

<https://youtu.be/qGO16O4PLJs>