

HOW DID THE PTEROSAUR SOAR ?

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Editorial Note — The Author deposited this text with the Editors of *Odonatologica* on 8 July 1980. It was his objective to work it out into a proper paper at “some later time”. Due to the pressure of manifold other work, he was not able to do so, therefore the original text is published here posthumously, as a historic document, in memory of this great odonatologist and independent thinker. His poem is set to the music of the popular “*Three blind mice ...*”. A correlation between the atmospheric oxygen levels and air pressure on one hand, and the dragonfly size on the other is currently considered as a possibility (cf. S. BROOKS, 2003, *Dragonflies*, p. 9, Nat. Hist. Mus., London).

If we reject the idea that dinosaur bones gradually enlarge while buried in the rocks, then we need some explanation as to how the pterosaurs flew (cf. SEELEY, 1870; MILLER, 1971; BRAMWELL & WHITFIELD, 1974; FREENEWALT/LAWSON, 1975; DESMOND, 1975). I reject the proposal that they clambered up the mountains, fell off the top and grabbed sufficient food on the downward glide to provide energy to climb up again. This may

satisfy an aerodynamicist but does not constitute a realistic ecological niche in the view of a biologist. Are we being excessively parochial, narrow-minded, unimaginative, not to say pedestrian? It is not only among pterosaurs that Nature appears to have been parsimonious in adequate provision for wing flapping. Long before Texas necessarily came up with the biggest pterosaur (LAWSON, 1975), the odonatologists had identified early forms of dragonflies with a wing length of over 300 mm (TILLYARD, 1928). These giants of the insect world could not climb up anything to glide down from because their legs were not adaptable to walking, but only to perching and grabbing food while in flight. Because they bred under water they must have flapped their wings somehow in spite of a miniscule muscular provision for so doing and a wing venation providing only a fraction of the lift available to present day forms.

Tektites arrived on earth without getting singed up by friction in the air, and hence at a time when there was little or no atmosphere (LIN, 1966). Cometary collisions or near-misses have been very reasonably proposed as the cause of termination of

geological eras (UREY, 1973). So there must have been times when the earth's atmosphere was, at most, sparse.

In order to fly in an atmosphere of 7.6 mm Hg or 76 mm Hg, instead of 760 mm Hg what steps would have to be taken? Surely a much greater wing area would be needed to gain any purchase in rarefied air and relatively little muscle power would be needed to flap a large wing in such a partial vacuum.

Might it have been reduced oxygen tension that led dinosaurs to grow so big anyway? When *Tyrannosaurus* ran, was it at a rate of, say, ten yards (not miles) per hour? In any event some of the bizarre features of the situation may be summarized thus:

Three wingéd lizards

Three wingéd lizards

How did they fly?

How did they fly?

Their wings expanded to beat upon

An atmosphere depleted by energy from

A near-miss comet where tektites belong,

Three winged lizards.

Protodonata of old,

Protodonata of old,

Flew in more rarefied air,

Flew in more rarefied air,

Though Mègânêura with its thirty inch span

Was greater than Mecistogasterid's clan,

The latter is better for thicker air than

The Protodonata of old.

References [pagination as stated in the original manuscript] — BRAMWELL, C.D. & G.R. WHITFIELD, 1974, *Phil. Trans. R. Soc. Lond.* (B) 267: 503; — DESMOND, A.J., 1975, *Times*, Lond., 12 Apr., p. 12; — FREENEWALT, C.H. / D.A. LAWSON, 1975, *Science* 188: 676; — LAWSON, D.A., 1975, *ibidem* 187: 947; — LIN, S.C., 1966, *J. geophys. Res.* 71: 2427; — MILLER, H.W., 1971, *Trans. Kans. Acad. Sci.* 74: 20; — SEELEY, H.G., 1870, *The Ornithosauria* [...], Bell, London; — TILLYARD, R.J., 1928, *Rec. indian Mus.* 30: 151-172; — UREY, H.C., 1973, *Nature, Lond.* 242: 32.