SUPPLEMENTARY DATA 3: DETAILS OF STATISTICAL METHODS

Analyses involving qualitative variables only: weighting system

To test statistically the significance of the distribution of specimens among qualitative categories, e.g. facies type, observed values for the number of specimens in each category were entered into a matrix (Table 1A, below). Assuming an even distribution of specimens among different categories, the likelihood of recovering specimens from each category is proportional to the abundance of the latter. Expected values were therefore weighted to account for differences in the relative abundance of each category. In the example shown in Table 1A (below), the observed total of 12 specimens, would, if all three facies are equally abundant, yield expected values of four in each; this is not significantly different from the observed values. However, as Facies 1 comprises 80% of the thickness of the interval, it should yield 9.6 (i.e. 12 x 0.8) of the total specimens recorded; this is markedly higher than the three observed. Conversely, the number of specimens in Facies 2, and particularly Facies 3, is higher than that expected.

To test the relationship between two qualitative variables, e.g. the presence/absence of a feature (e.g. a decay halo), and a categorical variable (e.g. the type of skeletal element absent), the observed number of specimens with the feature, and in each category, was entered into a matrix (Table 1B, below). Expected values were weighted according to the relative abundance of specimens in each category as follows:

(*Equation 1)* $$n_{ab_{\exp}} = \frac{n_a \times n_b}{n_c}$$

where $n_{ab_{\exp}}$ is the expected number of specimens in category a with feature b, n_a is the number of specimens in category a, n_b is the number of total specimens with feature b and n_c is the total number of specimens. In the example shown (Table 1B, below), out of a total of 40 specimens, 12 exhibit a decay halo and 30, gut contents; note that this total exceeds 40 as the two features are not necessarily mutually exclusive. The head, the tail and the limbs are missing in 10, 24, and six specimens, respectively. The expected number of specimens in which the head is absent, but a decay halo present, is therefore:

$$\frac{10 \times 12}{40} = 3$$

Similarly, the expected number of specimens in which the tail is absent, but gut contents present, is

$$\frac{24 \times 30}{40} = 18 .$$

Values are calculated thus for each cell in the “expected” matrix.

A

Facies	*percentage of total thickness logged*	*observed no. of specimens*	*expected no. of specimens assuming equal abundance of each facies*	*expected no. of specimens weighted for facies abundance*
1	80	3	4	9.6
2	10	3	4	1.2
3	10	6	4	1.2

B(i)

Completeness category	*No. of specimens*
Head absent	10
Tail absent	24
Limbs absent	6
Decay halo	12
Gut contents	30

B(ii)

Completeness category	*Decay halo*	*Gut contents*
Head absent	3	7.5
Tail absent	7.2	18
Limbs absent	1.8	4.5
Total	12	30

TABLE 1–Weighting system used to calculate expected values. A: Hypothetical example illustrating weighting system used for calculating expected values for the number of specimens per facies. B: Hypothetical example illustrating how the weighting system is applied to analyses of the relationship between multiple qualitative variables. (i) raw data; (ii) expected data matrix generated from (i) using Equation 1.