but those definitions leave the record crystal clear as to meaning. The entire purpose of definition is to explain unfamiliar entities or new activities with *familiar* concepts, not esoteric speculations.

Conclusions based on faulty assumptions (namely a mandatory young planet Earth and universe) will create all kinds of mistaken theories and unnecessary constructs.

Gorman Gray
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UNITED STATES OF AMERICA

John Hartnett replies:

Gorman Gray makes a few points I will comment on. He is unequivocally an old-earth creationist who wrests the Scriptures to make it fit in with his preconceived notion of an old universe. He says I have misinterpreted Scripture. No doubt the 'waters above' could refer to the water in the atmosphere. That is one possible interpretation, which is probably most widely held today. I was merely offering a suggestion of an alternative. But a clear reading of Scripture both from Genesis 1 and 2 Peter 3 tells us that the form of the original creation had something to do with Noah's Flood—i.e. water. I speculate on what that might be. Besides, 2 Peter 3 is merely telling us that the earth was made originally 'of water and out of water'. I think that means it was made out of water. For his own preconceived assumptions Gray has to insist that it means 'standing out of and in' the water. But I don't speculate on what the Lord meant when He said he took six literal Earth rotation days to create the universe—which Gray does in an effort to conform to the atheistic worldview, which has been determined by those who reject the simple plain reading of Genesis. Not only Exodus 20:11 but even more importantly Exodus 20:9 is impossible to consistently understand in light of Gray's six days to *create the biosphere*, when the Lord clearly tells us he did *all* of his work in those 6 days, not just a part of it.

I take exception with his comments that the original creation was not from pure water. Gray says 'The record in Genesis says nothing about water as the primordial Earth material later transformed into a planet but it refers only to an ocean on our planet as it is today, except universal until Day Three.' Clearly the Genesis 1:2 says God formed the elements and refers to them as the 'deep'. Water seems as valid or even better interpretation, in light of 2 Peter 3, as is Grays assumption that the earth was created the same as it is today but only completely covered with water. He insists the problem lay with 'poor translations of 2 Peter 3:5'. But surely they can't all be wrong—they mostly all say the earth was made of water. That seems plain simple reading to me. That is not too complex—6 days, Earth made from water. Gray warns against using 2 Peter 3 to interpret Genesis, but he himself misuses the poetry of Job to interpret it.

OK, I admit the icy halo is speculation—but not the 6-day creation, that couldn't be plainer. Gray is arguing the point because he wants Scripture to say something it doesn't and make it conform to his neo-gappist interpretation. He says 'Conclusions based on faulty assumptions (namely a mandatory young planet Earth and universe)'. So his argument is not about correct interpretation here but about my assumptions. He prefers his assumptions—that the universe is billions of years old and he is trying to get a 6-day creation scenario of the *biosphere only* that occurs billions of years after God created the universe, Earth, stars, planets, etc. He says 'Dr Hartnett also believes that because the great lights and stars are located *in* the expanse, this implies that the expanse extends out to astronomical distances, not just our atmosphere.' I believe this because Scripture plainly says that God *placed the great lights in the expanse.* I am trying to see where that leads. Gray's assumptions require he reject that because his expanse cannot include any part of the astronomical heavens because that would undermine his notion that the earth was covered in dark clouds until Day 1 of creation, which he extracts from poetry and not the narrative of Genesis. I am trying to understand the extent of the expanse (*raquia*). But one thing I am clear on is that Genesis tells us that God took 6 normal days to create the whole universe—that is simple enough to me.

John Hartnett
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Paleobiology databases

Kenneth Karle has done a good service in bringing the availability of *The Paleobiology Database* to our attention. We need such resources because global theories of life history (creation or evolution) can only be tested against global databases and global models. However, much more rigour is required in developing hypotheses and testing predictions using such data. When appropriate tests are applied to Karle's data we find his conclusion that 'There is no indication of fewer specimens with increased age' is incorrect. There is a highly significant difference, with at least twice as many 'young' fossils compared with 'old' fossils. However, even this conclusion is ambiguous, and perhaps even meaningless, because other possible explanations exist than the one that Karle suggests.

Karle's hypothesis was 'old fossils have far more time to erode than young fossils' and therefore should be less abundant in the fossil record. There are two ways of testing this hypothesis, and two different kinds of test that can be applied. We can compare fossil frequency in 'young' compared with 'old' strata, and/or we can look for a significant positive or negative trend with time. Karle's plots of the data show uneven variances across the time sequence, so we can either

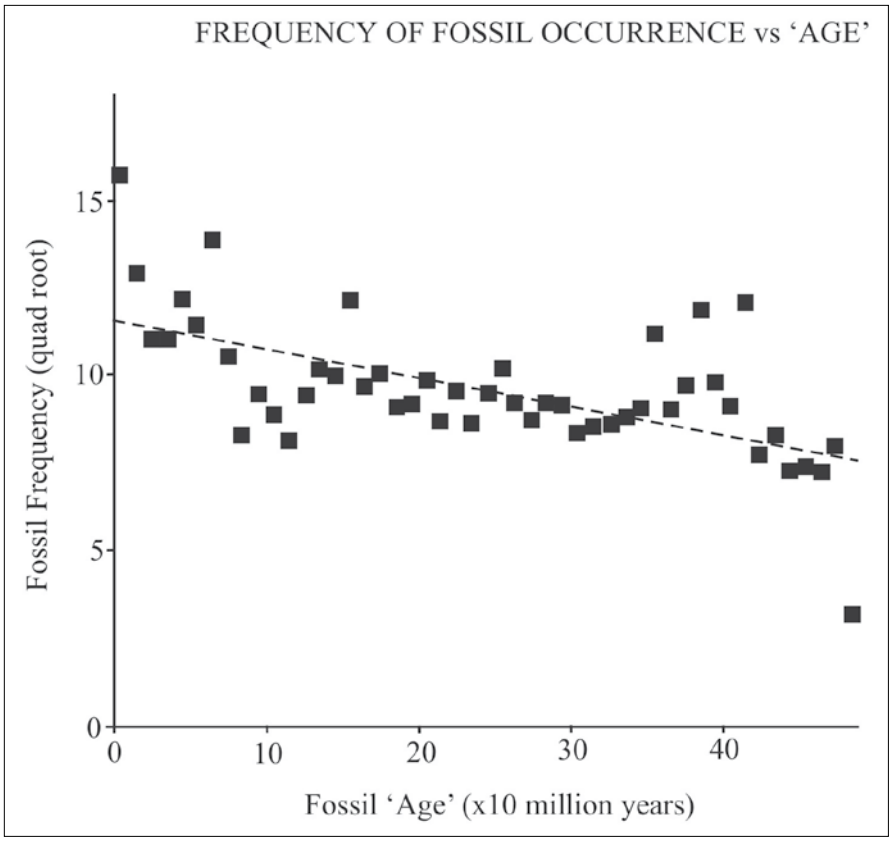

Figure 1. Plot of fossil occurrences (quad root transformed) against uniformitarian 'age' with frequencies pooled into 10 million year bins. The dashed line is the best fit least squares regression line, Y = 11.6 – 0.0808X.

transform the data to homogeneity and use parametric methods, or we can use non-parametric methods on the raw data.

Young vs old

The simplest way to determine 'young' and 'old' is to divide the time line in half and test whether the older group contains less specimens than the younger group. The Mann-Whitney-Wilcoxon ranks test for the difference between two populations is a suitable non-parametric test. The two samples are pooled (ignoring the 25th decile because the odd number of deciles (49) cannot be divided equally into two). The single series of 48 numbers is then ranked from low to high, and the rank sums for each of the two groups is calculated. The difference (T) between either sum and the expected value (E) is compared against probability tables. In our case, the tables for the *z* test can be used because the sample sizes ($n_1 = n_2 = 24$ in each group) are large enough for the test statistic (T) to approximate the Normal distribution.

The expected value for equal populations is $E = n_1(n_1 + n_2 + 1)/2$, and the standard deviation of E is: $s = (n_1 n_2 \{n_1 + n_2 + 1\}/24)^{½}$. The value of *z* is therefore $(T – E)/s = (730 – 588)/34 = 4.1$. The probability of this value occurring by chance is $p = 1.9 \times 10^{-6}$. We conclude therefore, contrary to Karle's conclusion, that there is a very highly significant difference between old and young fossil occurrences.

The totals for the two groups (data used here were downloaded on January 6, 2007) were 346,292 and 180,182 for 'young' and 'old' respectively, with the occurrences having been split in the middle of the 25th decile (10 million year bin) because there were 49 deciles. So there are almost twice as many 'young' fossils as there are 'old' fossils.

Trend with time

To test Karle's hypothesis for a monotonic trend, least-squares regression is an appropriate parametric method. This assumes homogeneity of variances across the time series and Karle's plot show this is not so. However, by using the square (or higher order) roots of the numbers rather than the numbers themselves, the assumption of homogeneity can be better approximated. The plot shown in the accompanying figure used a fourth root transformation and shows an approximately linear declining trend with age. The linear regression line is $Y = 11.6 – 0.0808X$. It has a correlation coefficient of $r = 0.590$ and with d.f. $= n – 2 = 46$ degrees of freedom is highly significant at $p << 0.001$. The predicted value for the frequency of the most recent fossils is $(11.6)^4 = 18{,}106$ and the predicted value for the most ancient fossils is $(11.6 – 0.0808 \times 49)^4 = 3408$, so the most recent fossils are about five times more common than the most ancient.

What does it mean?

Both tests contradict Karle's conclusion and show that young fossils *are* significantly more abundant than old fossils. What it means, however, is entirely another question. We could argue, for example, that ancient rocks are more likely to be deeply buried and thus less likely to outcrop at the surface and be discovered than younger rocks, so the result is nothing more than sampling bias and means nothing.

No doubt there is a range of interesting information to be gleaned from this database, as Karle suggested in his article, but much more thought needs to go into the development and testing of hypotheses and their alternates.

Alex Williams
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Kenneth Karle replies:

Both creation and evolution have a starting point with no life forms whether billions or thousands of years are involved. Regardless of the intervening values of the data, a reduced amount of the very oldest material is inevitable. Each of Williams' probability calculations is based on the *entire* data set. My paper explored whether the conventional ½-billion-year timespan is supported by the Paleobiology Database by looking for patterns *within* the data. It is subsets within that data that need to be analyzed for reverse trends or no trends.

If we exclude the first seven bins of data (the most recent 70,000,000 years) the trend line is almost flat (figure 1). If we also exclude the last seven bins of data, we find a pronounced increasing trend line for the middle $^5/_7$ of the data (figure 2). Excluding the first $^1/_7$ and last $^1/_7$ of data is arbitrary, but not unreasonable. It still allows an examination of 350,000,000 years of continuous unbiased data with a positive trend line toward greater age.

Because the Mann-Whitney-Wilcoxon test uses rank instead of values, it reduces the impact of very high or very low values. Only the first and last five bins of data need to be eliminated (instead of seven) to reverse the totals of the rank sums of the two groups. This quickly changes the conclusions reached via the Mann-Whitney-Wilcoxon examination.

The quad root analysis chart Williams submitted is mathematically correct, but again, if the oldest and youngest data were excluded, the trend line slope would be reversed. (This can be visualized quickly by covering the first and last seven dots with your fingers.) Using the quad root of the number of specimens, instead of the actual counts, artificially suppresses the large deviations of the off line values and masks the poor fit. Even as quad roots, there are data points that do not fit well with the trend line in several distinct areas near bins 10 and 40.

We can calculate the x-intercept of your derived equation at 1.44 billion years. There is no data recorded in the Database older than 490,000,000 years. Therefore the equation does not predict the older bins with accuracy. Bins 50 and up, if shown, would reveal the actual counts of specimens, which are zero. On the other hand, if we include all those zeros, the new best fit line would have greater negative slope—further diverging from the plotted data. The best fit line would sink below most of the oldest data

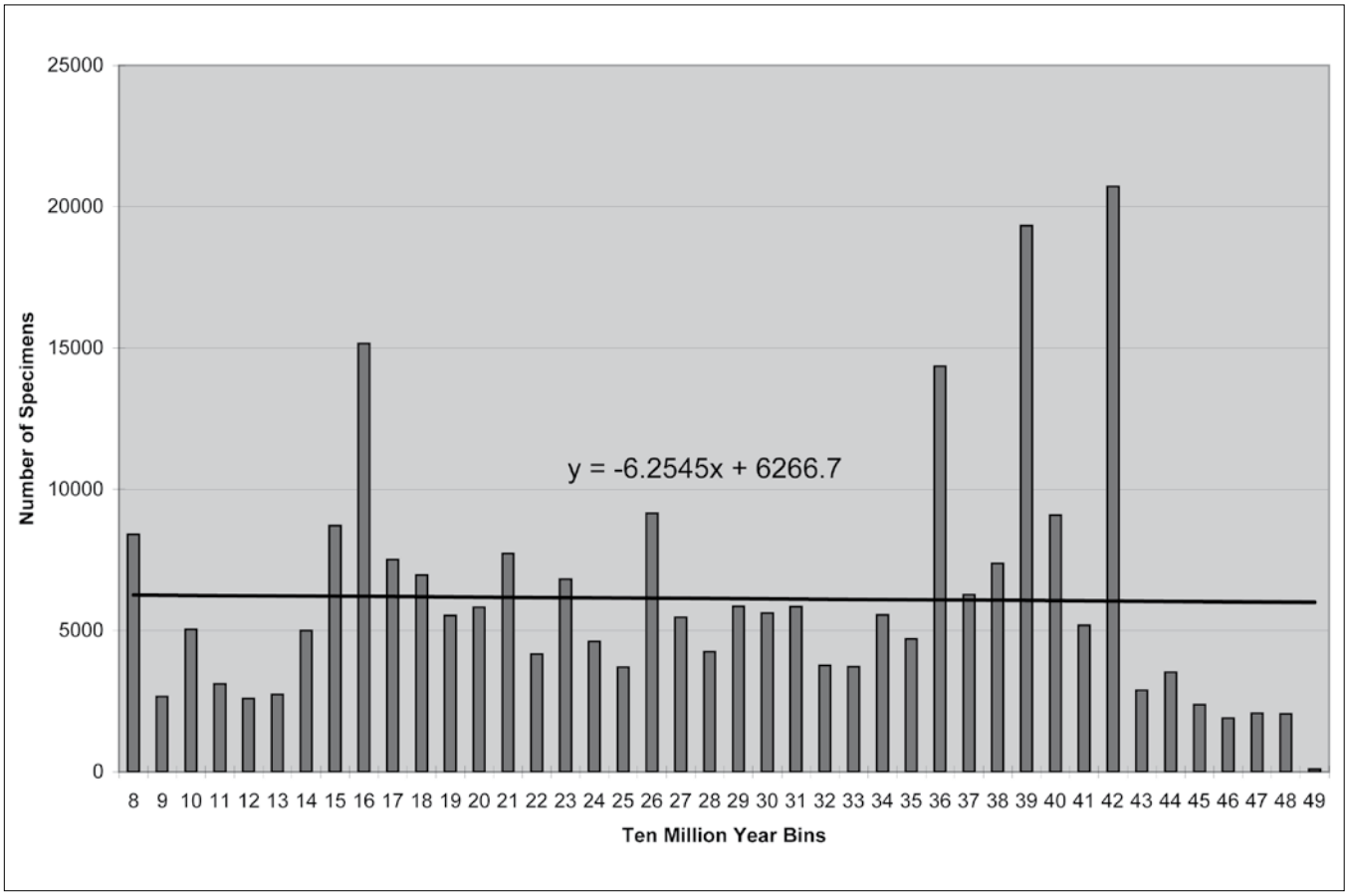

Figure 1. Best fit straight line of the worldwide specimen collection without the first 70,000,000 years of data. The trend line is almost flat for 420,000,000 continuous years of data.

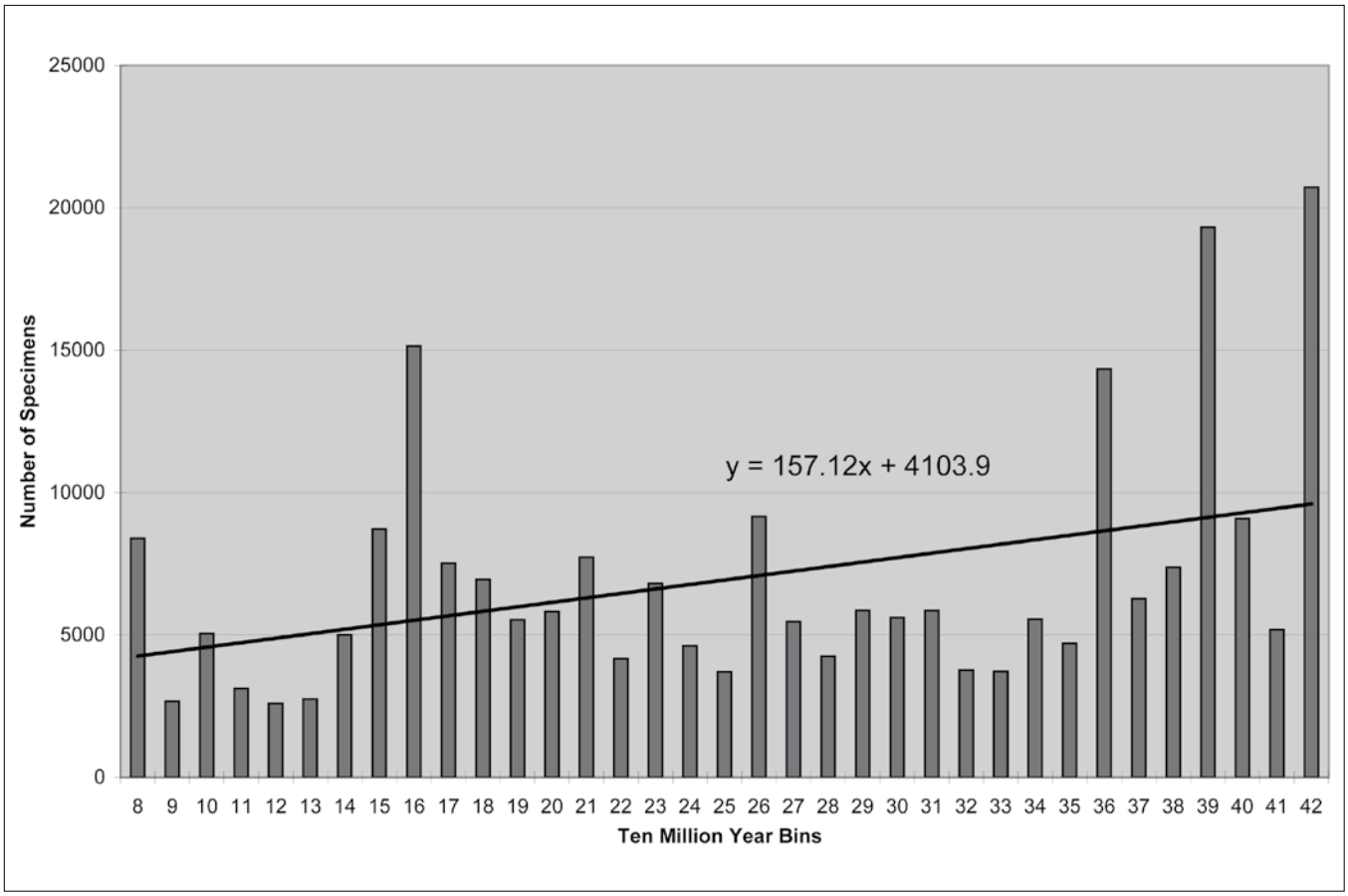

Figure 2. Best fit straight line of the worldwide specimen collection without the first or last 70,000,000 years of data. The trend line shows more specimens with greater age for 350,000,000 continuous years of data.

points, suggesting there are more old specimens than predicted.

Another of Williams' methodologies was to simply divide the data in half. He calls the first 240,000,000 years of data 'young', and the remaining 'old'. This is not a fair representation of what is commonly thought of as young. I submit that the 'young' material must all be somewhere in Bin One, which contains all of the order of magnitude 10^1 to 10^6 year old specimens. Surely the last 10,000,000 years of death, burial and debris should be better represented in the Bin One total.

We should not loose sight of the massive timespan being analyzed. All of the graphs presented are actual counts plotted against actual years. There is no logarithmic compression used. There are no parabolic trend lines developed. I submit that the values derived fall far short of those needed to support a half billion year time frame:

The youngest specimens are predicted to be *only* five times more common than the most ancient ones (after 480,000,000 intervening years).

The negative slope of the calculated quad root overall best fit trend line represents a decrease in the predicted number of older specimens of *only* 50 per 1,000,000 years.

The sum of the younger half of the specimens is *only* 1.63 times the sum of the older half. If we exclude just the first and last bin, the multiplier drops to 1.33 (based on my original data).

Williams' question, 'What does it mean?' is a valid one. My paper was based on the suspicion 'that the widely accepted fossil dating methodology is flawed and unreliable' and that 'a lot of "accepted" dates are wrong'. The circular reasoning of the fossils dating the strata and the strata dating the fossils forces the dates to be within definite ranges. Many contributors to this journal have proposed greatly condensed geologic time scales. If the Permian, Carboniferous, and Devonian (at least) were all deposited by one catastrophic flood, bins 25–41 should be condensed to less than one bin. Extensive mathematical analysis of the data is unproductive if the accepted dates are incorrect.

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