

Mass Extinctions as Shadows of Anti-Entropic Growth:

Macro-Ecological Revolutions

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What are the invariant, qualitative characteristics governing the history of life here on Earth? What does this history tell us about the universe in which we live?

What lessons must we learn, if our own species is to survive the present threats?

Over the recent few years our Basement team has taken up these questions, and here I present a short but significant contribution to this ongoing investigation. The other night the abstract of a 2002 academic paper on evolution drew out my curiosity, specifically its last sentence,

Early Paleozoic radiations established stable ecosystem relationships, and thereafter only the great era-bounding mass extinctions were able to break patterns of incumbency, permitting the emergence of new community structures with distinct proportional diversity relationships.¹

Having participated in developing our Basement team's thesis on mass extinctions—that they express the anti-entropic development of life as a whole expressing itself against the fixed nature of any particular, individual ecological system—this concluding sentence of the above mentioned abstract piqued my interest, not necessarily for the conclusions which its authors may draw, but for the implications of the evidence they might present, understood in the context of our ongoing work with Lyndon LaRouche on the subject of creativity in the history of life.² Any given stage of an ecological system is inherently bounded, and yet life as a whole has continued to progress beyond such fixed constraints—as if being pulled from somewhere beyond that initial system. It is this process of advance, as measured in the progression to higher levels of biospheric energy flux density, that defines the character of, and necessity for extinctions, even the very largest of the mass extinctions, as we will see here.

To get to the new evidence a little background is required first. This 2002 study examines the changes in marine biodiversity over the past half billion years, as expressed to us in the fossil records. There are various measurements of this, such as by counting the total number of **families** or **genera** recorded at any given time.³ [Graphic 1]

These biodiversity records have been analyzed in search of

underlying structures or patterns in the history of life.⁴ For example, one of the most famous divisions is known as the “three evolutionary fauna.” First discovered in the early 1980's,⁵ it was seen that three successive groups of animals dominated the planet, the Cambrian group, the Paleozoic group, and then the Modern group. [Graphic 2]

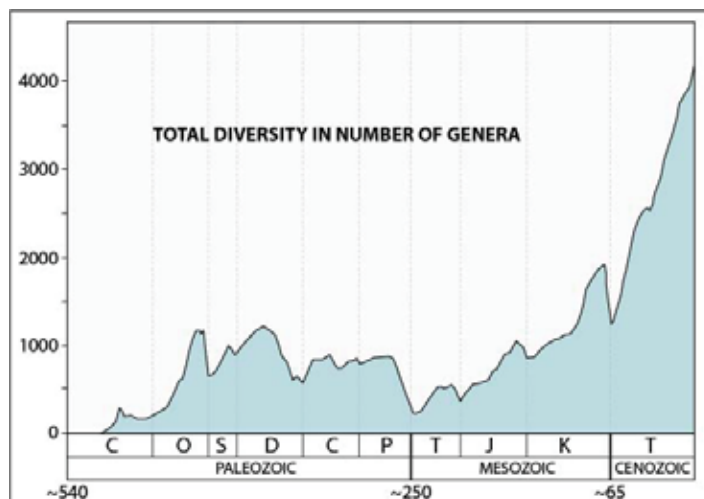
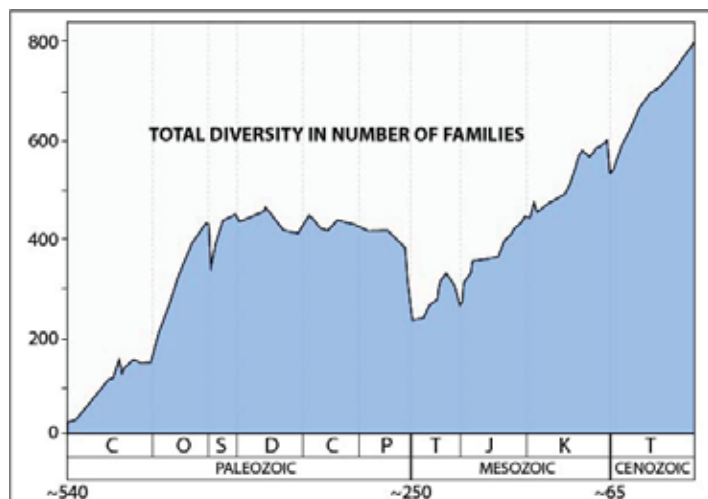
As will be seen below, these studies indicate very specific conditions required for the survival of any species, including our own. The idea of a universe governed by the Second Law of Thermodynamics is shown to be a complete fraud—*meaning if mankind is to continue to exist in this universe we must completely abandon the entirety of the “sustainability,” or green ideology, and revive a commitment to true physical economic progress.*

Conditions for Survival

This classic division of the biodiversity record is interesting, but it is not the only structure we can identify in the fossil record. In the 2002 study quoted above, the authors decided to try something new, dividing the entire biodiversity record by specific **physiological characteristics** of living organisms.⁶ Classifying different organisms by those characteristics, they could then examine what relationships emerged from the biodiversity record as a function of this new classification.

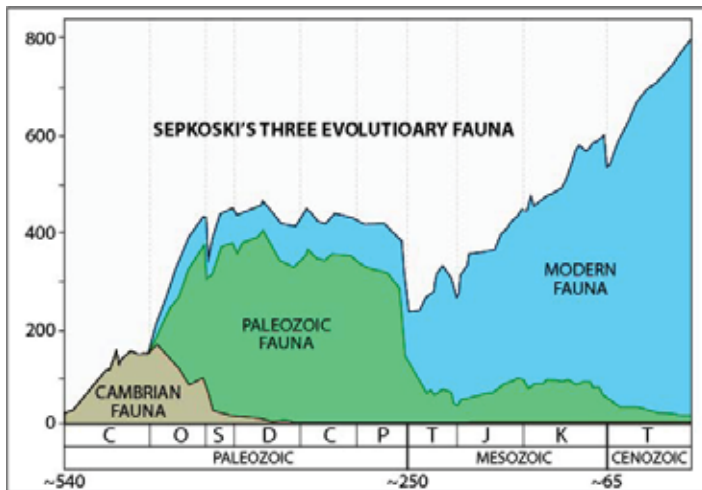
The physiological characteristics chosen express significant qualitative features of living organisms, and are very much coherent with what we've been discussing in our Basement research.

For example, one feature of life that we have discussed is what we might call the **increasing self-determination of life**—the power of life to more and more determine its own conditions of existence, becoming less of a passive participant on Earth, and more of a determinator, dramatically changing the face of the planet in order to meet life's needs. For example, the “Hypersea” concept of life's colonization of the land expresses this very clearly.⁷ For life to move onto land, the plants had to bring an entirely new water cycle onto land, literally changing the entire planet forever (including the electromagnetic conditions extending far, far beyond the planet's surface)—*granting life a greater freedom to spread its reach and act.* Or take the development of the water-tight skin of reptilian



Graphic 1. Two examples of measuring biodiversity over the last 540 million years, one at the family taxonomic level, another at the genera level.

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Graphic 2. Sepkoski's "three evolutionary fauna" (groupings of animals), measured in the total number of families found at any given point in time over the past 540 million years. First image with all three groups together, second with each group separate.

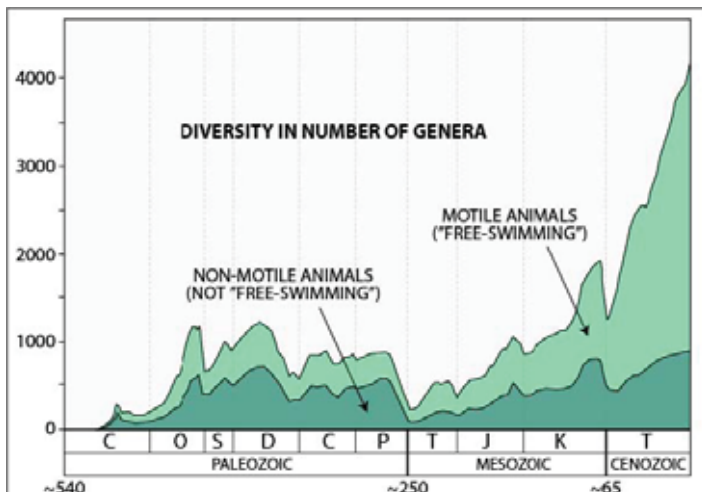
animals, freeing them from being immediately tied to moist environments, as were their amphibian cousins. The shelled egg was another crucial development, separating life from a purely water-dependent life cycle (such as the tadpole stage of the amphibians). Advances in thermoregulation and warm-bloodedness were also considerable innovations, breaking the metabolic activity of living organisms free from being bound to the ambient temperature.⁸ The list goes on.

Associated with this process has been the steady increase in the energy flux density of the biosphere as a whole. Both the total energy of the system and the rate of consumption per organism have increased, characterizing a definable metric of **biospheric energy flux density**, a direct correlative with the progress of life.⁹

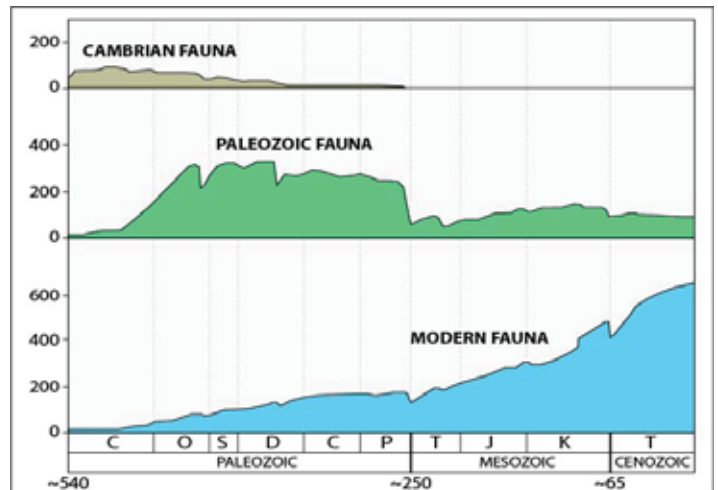
For the 2002 study in question, they choose three key physiological characteristics which are relevant to our own investigations:

1.) **Motile vs non-motile animals:** simply, if the animals had the ability to willfully move around (motile), i.e. free-swimming, or if they were just passive animals, floating around in the sea (or stuck on the bottom), with no means to move themselves around.

2.) **"Buffered" vs "unbuffered" animals:** distinguishing between animals more susceptible to being directly influenced by their immediate environment, and those more independent.¹⁰ For example, and perhaps the most interesting for our immediate investigation, the "buffered" animals have higher



Graphic 3. Genera level marine animal biodiversity over past 540 million years, divided into motile and non-motile animals. Graphic reproduced from Bambach et. al., 2002.



metabolic rates than the "unbuffered."

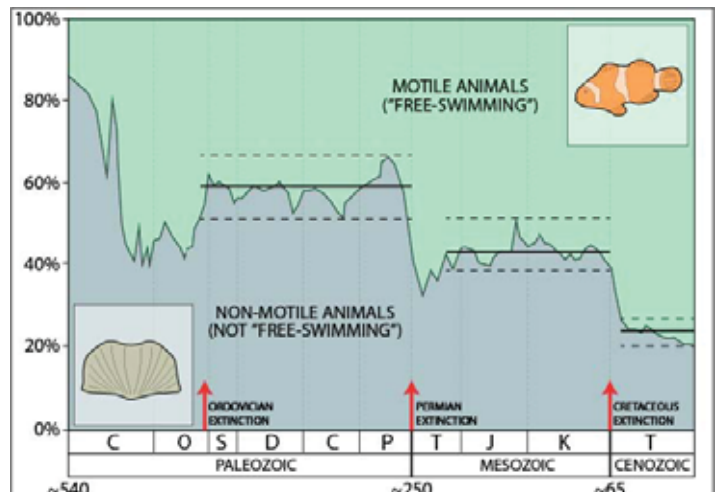
3.) **Predation:** examining the biodiversity of predators (animals which live by consuming other animals) relative to non-predators. As is noted in other studies, predation itself is a very energetic mode of life, and as such was much rarer in earlier periods.¹¹ Predation has only increased as the entire energy-flux density of the biosphere as a whole has increased, making it a useful indicator of that process.

Taking the entire biodiversity record over the past half billion years, we can classify species according to these physiological characteristics to see what the fossil records tell us. Starting with the motile vs non-motile animals, we have the following graph. [Graphic 3]

We see that the motile and non-motile animals follow the same general ebbs and flows of biodiversity over this entire period, expanding and collapsing together. However, instead of focusing on the total levels, if we just examine the ratio of motile to non-motile animals something much more interesting appears.

Remarkably, despite the general fluctuations of the overall biodiversity trend, clear plateaus emerge with relatively *stable ratios* between motile and non-motile animals over very long periods of time. For example, across the entire Cenozoic era (the past 65 million years) the biodiversity has been steadily increasing for both motile and non-motile animals, but the ratio between them has remained generally the same. [Graphic 4]

As indicated in the graph, three clear plateaus stand out



Graphic 4. Proportion of motile to non-motile marine animals over the Phanerozoic. A fish is given as an example of a motile animal, and a brachiopod as a non-motile example. Graphic reproduced from Bambach et. al., 2002.

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most clearly, which we will refer to as the Paleozoic system, the Mesozoic system, and the Cenozoic system. So instead of either continuous change, or erratic change, the growing dominance of motile life occurred through three discrete steps. This indicates life's inherent direction towards a self-determining character, as freely-swimming life became more and more dominant. What's more, certain boundaries demarcate discrete shifts in the entire ecological system of life. These aren't just arbitrary boundaries.

The major transitions from one stable system to the next are marked by mass extinction events! In fact the Ordovician, Permian-Triassic (P-T), and Cretaceous-Tertiary (K-T) mass extinctions are thought to be the three largest mass extinctions of this entire half billion year period.

Examining this entire arc, what do the mass extinctions express from the standpoint of the process in its entirety?

Though they are traditionally seen as purely destructive events, *they are only destructive relative to the fixed system being surpassed*. Whereas any particular ecological framework is fixed, as the species participating within it can not willfully change their behavior, the system of life, taken as a whole, does move to higher levels of organization.

It is this progress, moving from one system to the next, which is the real principle governing the process. Since any particular species has a fixed ecological existence, as the biosphere moves to a new level those species that can not keep up are eliminated. The larger the up-shift, the larger the mass extinction—*extinctions as the shadows of progress*.

This is a subject the Basement has discussed extensively in terms of a heuristic conical expressions of our three stages in this process.¹² [Graphic 5]

Biospheric Energy Flux Density

Examining the second physiological characteristic, “buffered” vs “unbuffered” animals, uncovers the exact same set of systems. Again, even though the total biodiversity fluctuates extensively, the *proportions* show that life advanced through three successive systems, as the “buffered” forms of life (more independent from their ambient environment) became increasingly dominant. [Graphic 6]

One particularly interesting character of buffered organisms, *their higher metabolic rates*, sheds some light on how these system up-shifts have occurred. The significant difference in metabolic rates between the two systems is highly compelling, as the different metabolic rates of various species have a clear generalized relationship to Vladimir Vernadsky's work on the organization of the **biosphere** as a whole, specifically as expressed in his understanding of the “biogenic migration of atoms.”¹³

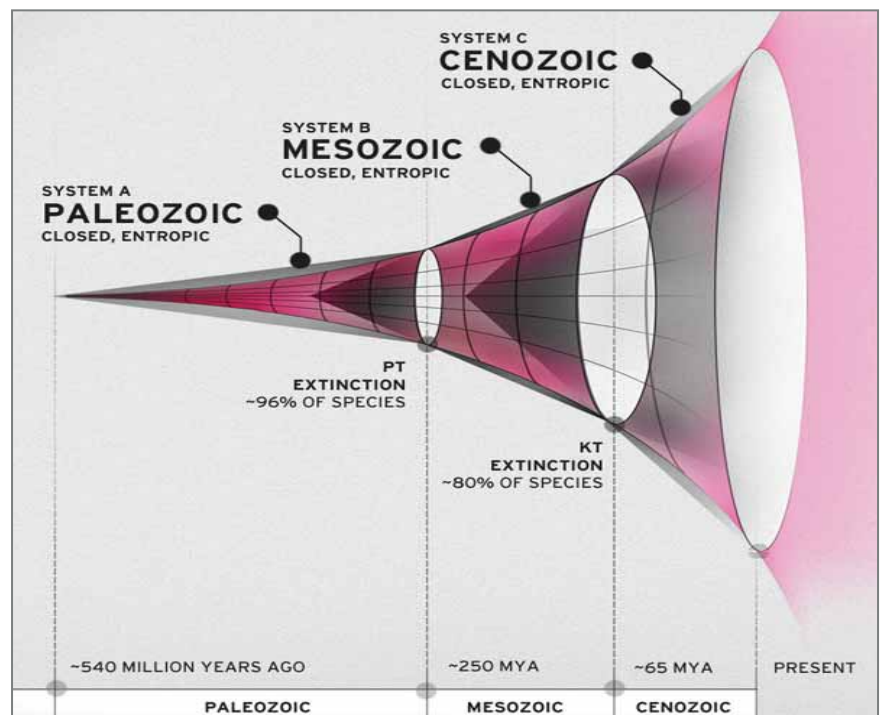
What we are seeing with the step-wise take-over of the “buffered” animals (with their higher metabolic rates) necessitates jumps in the rate of flux of the biogenic migration of atoms throughout the entire biosphere, a clear expression of the increasing biospheric energy flux density.¹⁴

This takes us directly to the third physiological characteristic under consideration, *predation*. [Graphic 7]

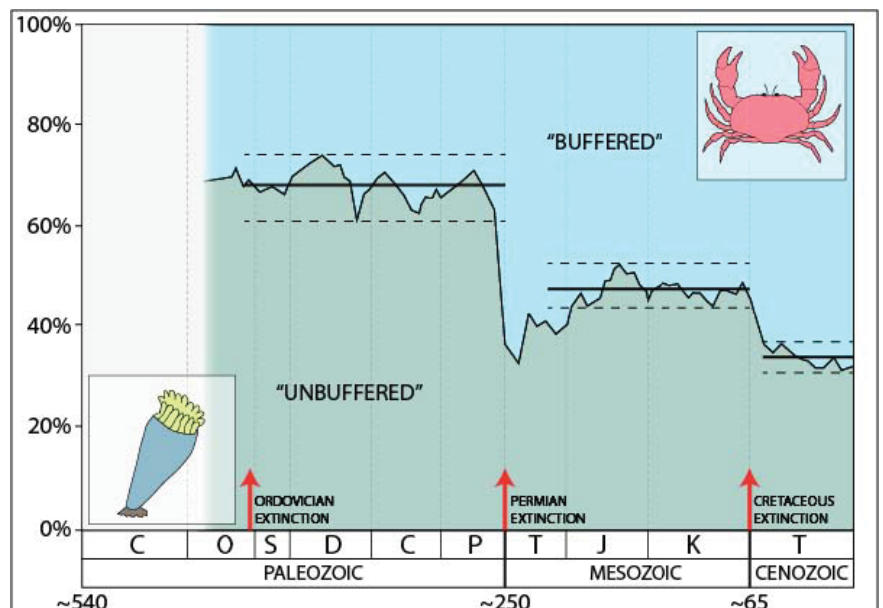
As mentioned above, the increase in predation directly expresses up-shifts in biospheric energy flux density. To quote from one study relating to the subject,

*The increase in predation over time indicates that more calories are being spent in the fauna with the passage of time. Because the survival of predators requires an adequate biomass [food web] to support them, the increase in the number of predators over time suggests that the biomass of the prey must have increased to support them.*¹⁵

There is more that can be said on the significance of predation, but taking this together with the leaps in metabolic rates, we have clear expressions of a metric for the anti-entropic development of life here on Earth, occurring in three successive macro-ecological systems.

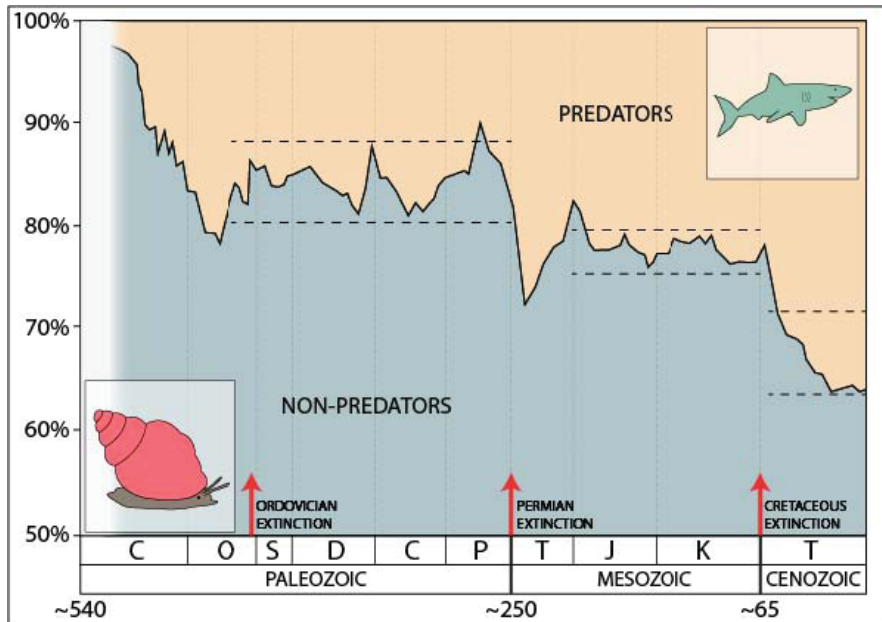


Graphic 5. Three successive macro-ecological systems in the history of life.



Graphic 6. Proportion of “buffered” to “unbuffered” marine animals over the past 450 million years. An example of a buffered animal is a crab, an unbuffered example is an ancient form of coral. Graphic reproduced from Bambach et. al., 2002.

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Graphic 7. Proportion predator to non-predator species over the past half billion years. A shark is an example predator, and a sea snail is a non-predator. Graphic reproduced from Bambach et. al., 2002.

That is, until the emergence of mankind. Never before, in the entire history of billions of years of life, have we seen a species that can willfully subsume and act upon this entire process. With mankind that power exists. The qualities of system up-shifts that took life millions of years, and necessarily required the elimination of countless species (purely as a consequence of life's own inherent ecological/biological characteristics), mankind has the potential to generate, even within a single human lifetime. We do not do this by changing our biological structure, but through the action of the uniquely willful creative powers of the human mind.

Through the willful action of the human mind, man wields the force of billions of years, the force of shaping entire worlds—and we are even now only beginning to get a glimpse of what a thermonuclear, or even matter-anti matter mankind can be, as a true creator in the universe.

If we wish to keep with rigorous technical terminology, we can not justifiably use the term “species” to encapsulate these qualities of mankind.

Given the potential for what can only be defined as fixed-species-transcending actions, perhaps the term “metaspecies” would be more satisfying to the subject at hand? To be the most precise, we have Lyndon LaRouche's scientific determination of mankind as the *potentially immortal species*.

But this only comes with the willful choice to act. We have hundreds of millions of years of warning, as the inherent directionality of life in this universe guarantees an inescapable fate to any fixed (i.e. “sustainable”) mode of life—whether fixed purely for unchangeable biological reasons, or fixed by the immoral choices of action, or inaction.

Thus, *the lesson of the mass extinction*—one to be taken with the utmost seriousness and urgency at the immediate time.

The Principle of Survival

Despite the general fluctuations in the total biodiversity over time, the *relative changes* in dominance of three physiological characteristics each independently demonstrate our three successive macro-ecological systems. Taking the process in its entirety, life has successfully transitioned from one system to the next, even though any given species may or may not have been able to continue to exist, given its particular fixed mode of existence.

Thus, *the irony of the mass extinction*.

These great kills can never be understood outside of the larger context of the principle of the anti-entropic progress of life. The largest mass extinctions on record over the past half billion years demarcate the largest system up-shifts, and the largest increases in biospheric energy flux density.

Footnotes

¹Richard Bambach, Andrew Knoll, and John Sepkoski, *Anatomical and ecological constraints on Phanerozoic animal diversity in the marine realm*, May 14, 2002; PNAS.

²See the January 26th, 2012, LaRouchePAC Weekly Report, *The Economics of Extinction*, <http://larouchepac.com/weekly/jan26>

³This is keeping with the standard biological taxonomic system:

phylum → class → order → family → genus → species.

⁴Such as the ~26, ~62 and ~140 million year periodicities in biodiversity discussed in other locations.

⁵See, John Sepkoski, *A factor analytic description of the Phanerozoic marine fossil record*, *Paleobiology*, Vol. 7, No. 1, Winter 1981, page 36-53.

⁶They make an interesting note about the original derivation of the three evolutionary fauna: “no biological criteria were used to group the taxa *a priori*, and the only unifying biological attribute suggested by the study was a similar level of evolutionary volatility among members of each fauna.” That is, the rate of emergence and extinction was the only consideration used to identify these three groupings as distinct subsets of the entire biodiversity record.

⁷See LPAC-TV, *The Hypersea Platform*, <http://larouchepac.com/hypersea-2011>

⁸See LPAC-TV, *The Ecology of Anti-Entropy*, <http://larouchepac.com/node/19467>

⁹This will be the explicit subject of an upcoming writing, “In a Series on Anti-Entropic Ecology: Defining Biospheric Energy Flux Density,” to be completed by this author.

¹⁰To quote from the paper, “[unbuffered animals are] characterized by low rates of metabolism, limited internal circulation, gas exchange across little differentiated or undifferentiated body surfaces, and massive investment in CaCO₃ [calcium carbonate] skeletons... [whereas ‘buffered’ animals are] characterized by relatively high metabolic demand, well developed gills and circulatory systems that aid in physiological regulation, and skeletons limited in mass or made of materials other than CaCO₃... [buffered and unbuffered groups] identify distinct and biologically coherent suites of animals based on physiological responses to certain types of environmental perturbation. [Unbuffered Animals] can be regarded as open systems, vulnerable to or ‘unbuffered’ against a range of chemically related physiological stresses. In contrast, [buffered animals] comprise closed, physiologically ‘buffered’ systems expected to be less vulnerable to ambient chemical insult.”

¹¹For example see, *Seafood through time: Changes in biomass, energetics, and productivity in the marine ecosystem*, Bambach; *Paleobiology*, Vol. 19, No. 3, Summer 1993, pages 372-397.

¹²A broad presentation of the qualitative shifts between the Paleozoic, Mesozoic, and Cenozoic macro-ecological systems is being prepared in the form of a large table.

¹³See V.I. Vernadsky, *The Biosphere* (Complete Annotated Edition), Springer, 1998.

¹⁴See LPAC-TV, *The Ecology of Anti-Entropy*, <http://larouchepac.com/node/19467>

¹⁵*Seafood through time: Changes in biomass, energetics, and productivity in the marine ecosystem*, Bambach; *Paleobiology*, Vol. 19, No. 3, Summer 1993, pages 372-397.