

Morphological Variability as a Basis for Palaeontological Classification

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On the occasion of the eightieth birthday of Professor Milan Herak, it is certainly our responsibility and pleasure to trace the many articles and other works that highlight the professor's scientific contribution to Croatian geology or palaeontology. Given that it is exactly fifty years after the publication of one of Professor Herak's palaeontological works, this is a relatively positive chronological distance from which it is possible to evaluate his contribution to our field.

In his exceptionally prolific professional life, Professor Herak spent almost a decade, 1943-1952, as a curator in the Geological and Palaeontological Museum in Zagreb. Here, he was concerned with research into the rich osteological collection of cave bear remains (*Ursus spelaeus*) that the museum possessed, and this work culminated in the publication of a fairly large scientific work, in 1947, entitled "Starost i sistematske značajke spiljskog medvjeda Hrvatske" (The Age and Systematic Characteristics of Cave Bear of Croatia). There are many reasons this is a pioneering work in the history of Croatian vertebrate palaeontology, following the significant offerings of Herak's predecessor in the museum - Professor Dragutin Gorjanović-Kramberger. At this time new theoretical hypotheses and new syntheses of evolutionary theories were applied globally to the past and present world resulting in greater understanding of evolutionary mechanism of biological change. Herak's 1947 paper is a good example of how, even in our time it is necessary to understand the theoretical foundations of various methodical and palaeontological classifications, determinations, and systemic organizations, in order to understand the various morphological entities, throughout geological history which represent once living organisms.

Herak was concerned with the morphological variability of an extinct species, and within the context of samples available in the Museum, he attempted to define the theoretical and practical basis for the taxonomic determination of a fossil species. Different theoretical approaches to taxonomic classifications have

existed from the period of Linnaeus and attempts at identifying the living and non-living world in the natural system of "*Scalae naturae*". If discovery is merely the first distinct phase of scientific activity, then description and subsequent categorization, i.e. systemization of such discoveries follow, leading to a final, complete synthesis, and comprehension of the totality and causality of the world that we are studying. Herak incorporated all those levels of scientific inquiry in his approach to science from the very beginning.

It was already young Charles Darwin who wrote that geologists when deriving facts from the past need not always begin with the description of the colour or size of a pebble of gravel discovered in a complex of deposits. Considering the diversity of the gravel, distinguished by many details or a classificatory typology, they would need, according to Darwin, thousands of years to describe the diversity of all the gravel of the world. We cannot know whether these sentences of Darwin were to determine Herak's approach in 1947 to studying the different "varieties" or numerous features of fossil finds of cave bears in the collections of the Zagreb museum, but Herak's sentences indicate an advanced level of theoretical knowledge and practice in the methodological approach to scientific work. "*Thus we also shall not consider our material separately, rather we shall attempt to establish its relation to the whole...*", writes Professor Herak, "*...in this manner we shall establish the systematic significance of our cave bear, meaning that we shall be able to establish whether it can be considered a typical representative of the species *Ursus spelaeus*, or whether this was some kind of new variety or race*". Such reflections are not far from the fundamental viewpoint of every palaeontologist today.

Herak's starting point for studying the varied cave bear remains, from diverse ice age deposits and sites throughout Croatia, represented for many, a new approach to distinguishing and understanding the complicated variability or "typologies" of individual organisms. It

was then necessary further to comprehend what is in the substratum of many biological processes, which are eventually deciphered through the morphology or morphometry of petrified bones. Before we state the current judgment about this innovative work in Croatian palaeontology by Professor Herak, it is necessary for us to remember several almost general facts from the history of the palaeontological sciences. The fundamental methodological starting point for determining a fossil as some kind of document or entity according to which we classify and reconstruct the history of life on Earth has been known, probably from the 18th and certainly from the beginning of the 19th century. If the theory about the evolution of the living world, which originated in the middle of the last century, changed the central concept of palaeontology, then the 1940's were the origin of the so-called synthetic evolutionary theory as a sort of scientific, Kühn-derived paradigm, in a modern view of population biology. The works of Huxley, Fisher, Mayer, Stebbins, Wright, and in palaeontology, G.G. Simpson, changed the concept and approach to the study and understanding of variability, and subsequently the evolution of the organic world. It should be emphasized that the first scientific activity of Herak in palaeontology corresponds to the years of the appearance of new synthetic theory of evolution of the organic world, and in this context, Herak's 1947 paper is a small, but significant contribution from Croatian palaeontology to world literature that marked this period.

Many modern books about the evolution of species teach us today that nothing is worse for evaluating the work of a scientist studying the history of organic evolution than an evaluation that someone in approaching a palaeontological determination of a fossil entity has gone no further than looking at typologies, the distinction of a particular entity for which no biological significance is known of the complicated process of variability. The color or size of those gravel pebbles of Darwin's, or the greater or lesser skull size of some animal, yet another secondary cusp on the molar of a large mammal, or some other isolated morphological feature, are not in themselves the means by which the variability of the organism is expressed, if in this we forget that no single leaf is identical to another on a many branched tree. "Ideal types" or even "morphotypes" are only the philosophical fiction of our artificial, often subjective conceptual approach to the systemics of the organic world. Thus Herak, with his work on the heterogeneous cave bear remains, began to move away from the current typological viewpoint of the palaeontological determination of biological entities. "Large" and "small" bears and morphometrical large and small organisms existed once and exist now. Establishing their existence is perhaps merely manufacturing a record about some of "Darwin's gravel", but studying the size, form, and structure of many pebbles, their origin, genesis, and much else related to the pebbles requires much greater knowledge about the mountain

from which the pebbles were derived, the forces that rolled them, and the rock from which they originated.

Today we know that typological conception, the distinction of types and morphotypes represents the opposite to considering evolution through all individuals, the population of a given type from the area of its existence. As Herak stated, "...in the first beginnings of researching the cave bear, they tried to note the forms which differ to a great extent from the rest as varieties. In this manner, they ascribed some systematic classification. However, more recent research", and here Professor Herak states, following Professor Ehrenberg of Vienna, "...shows that there are no secure criteria or scientific basis according to which each phenomenon of variability need be noted as a variety.", (i.e. morphotype) with clearly established systematic boundaries of independent classification. "All of this caused me critically to consider the material from our sites and to ask if within this material there existed a form that we could denote as a special variety or race of the species *Ursus spelaeus*, i.e. do forms exist among them that agree in principle with the others? But according to some characteristics, which must in general be of a gradual nature, they occupy an isolated and constant spot not merely among the forms from their own site, but also within the general variant curve."

Herak was particularly concerned in this study with the morphological variability of the cave bear remains from the classic Pleistocene site at Krapina. Its excavator, D. Gorjanović-Kramberger, attempted many times to examine the possible homogeneity of morphological variability in distinguishing species, varieties, races, types, and so forth. In his palaeoanthropological works he strongly resisted distinguishing various types of ancient hominids at the Krapina site, instead writing more about the mechanism of perceived morphological variability. Thus according to Gorjanović-Kramberger, "*Homo hauseri*" or "*H. aurignaciensis*" did not exist at Krapina, but rather the variable model "*H. primigenius*" (RADOVČIĆ, 1988) in contrast to the views of KLAATSCH (KLAATSCH & HAUSER, 1910). Similarly, when GORJANOVIĆ-KRAMBERGER (1913a) attributed the remains of a cave bear, or in another work a rhinoceros (GORJANOVIĆ-KRAMBERGER, 1913b), to individual varieties or systematic categories, such as "race" or "breed", which he names as "*krapiniensis*" types, then this is more an expression to distinguish another population, which is chronologically or geographically separated from the comparative sample. In this segment of Gorjanović-Kramberger's theoretical basis lies the beginning of the modern population approach to systemics, while in the work of Herak it is already a working hypothesis. Thus, in the morphologically "irregular" crown of the molar of the *Ursus speleus* species from Krapina, or in the diverse skulls and teeth of this animal from other Pleistocene sites in Croatia, Herak sees merely an emphasized morphological variability over a wide area or a greater stratigraphic span of available samples. It was once thought that the

“Krapina sequence” could represent a long Pleistocene span from the last interglacial (Riss-Würm) to the penultimate Würm stage (MALEZ, 1970), and thus a lengthy chronological sequence that would eventually justify the existence of a special taxonomic unit. More recent determination of the absolute age of the Krapina site indicates an entirely short stratigraphic span of Pleistocene deposits at Krapina (RINK et. al., 1995). Thus the work of HERAK (1947), was a correct and suitable technique for Croatian palaeontology in that period. Unfortunately, a broader analysis of the palaeontological works that were to follow Herak’s text show a significant deviation from this work that could have served as a model.

In conclusion, Herak established that individual examples of osteological material do not offer a basis for establishing certain varieties and races in the study of the characteristics of individual taxonomic entities. All differences between individual forms clearly can be differences of individual variability resulting from a combination of many biological mechanisms. Thus it seems justified to state today that Herak in 1947 first introduced into Croatian palaeontological literature, the principle of populational approach in the classification of certain morphological variants, and that this occurred simultaneously with the first similar attempts in international literature.

Finally, it seems to me today that often in the lack of theoretical and practical qualifications, as well as in ignorance of the modern developments in palaeontology as a scientific discipline, in our profession and the pseudo new morphological considerations, the typological manner of studying the fossil world is again beginning to appear, the establishment of specificities without taking into account the integrity and context of the totality, and even the entire organism. Sometimes certain works remain at the level of the study and distinction of individual elements (as the ancient Greeks saw in fire an element instead of a process). Inasmuch as research into the organic world of the geological past is also research into the once extant organic process, the dynamic relation between population and the environment in some period, then the achievements and knowledge that Herak published fifty years ago is a foundation stone that we need not speedily fill over. His discussion about the systemization and characteristics of the cave bears of Croatia, printed in 1947, at the beginning of his prolific and many-faceted scientific career, remains a classic lesson even for the researchers of today.

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