

## THE ULTIMATE HOAX: ARCHAEOPTERYX LITHOGRAPHICA

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### ABSTRACT

The recent claims that the London specimen of the Archaeopteryx is a hoax have been clarified and there would seem to be grounds for suspicion. The published work on the Berlin specimen shows that it has every indication of being a hoax of the same kind, that is, a modified, genuine fossil of the Compsognathus. All four of the more recent "discoveries" are shown to be nothing more than reclassifications of genuine fossils of the same small dinosaur.

### INTRODUCTION

To many people the very word 'fossil' causes about as much excitement as watching grass grow. However, when we lift the veil which shrouds the world's most famous fossil, we find a labyrinth of intrigue and deception making it all somehow far more palatable. The fossil of the Archaeopteryx is said to be the paleontologist's "Rosetta Stone" providing irrefutable evidence that evolution of the species actually occurred. It has taken pride of place in every biology textbook for over a century and has recently been wreathed in controversy following the claims that one of the principal specimens is a fake. We will first trace out the history of the discovery of the various specimens, then examine the claims that the London specimen is fraudulent. Following this, we will determine if the more famous Berlin specimen can withstand the harsh light of scrutiny. It will be shown that the weight of evidence from both human activity and technical detail for all the known specimens points overwhelmingly to both the London and Berlin specimens of the Archaeopteryx being nothing more than a clever hoax.

### THE DISCOVERY OF THE SPECIMENS

When it came to evidence for his theory, Charles Darwin lamented that none had yet been discovered. Writing in 1859 he said:

...as this process of extermination [survival of the fittest] has acted on an enormous scale, so must the number of intermediate varieties, which have formerly existed on the earth, be truly enormous. Why then is not every geological formation and every stratum full of such intermediate links? Geology assuredly does not reveal any such finely graduated organic chain; and this, perhaps, is the most obvious and gravest objection which can be urged against my theory. The explanation lies, as I believe, in the extreme imperfection of the geological record. [1].

And to this day this is still the tidy explanation offered to the public. An unintended side-effect of the publication of Darwin's Origin was that by bewailing the absence of "intermediate varieties"; i.e., fossils of creatures in transition from one species to another, a charter was provided for fossil forgers. As early as 1833 French paleontologist Geoffroy Saint-Hilaire had proposed that the birds had evolved from the reptiles [2] and later Darwinian enthusiasts began to speculate on what some of these transitions should have looked like; the alleged transition between the reptiles and the birds was based upon the fact that the bone structure of certain extinct dinosaurs and that of the birds have some similar features.

Within a matter of months after the publication of the German edition of the Origin, paleontologist Hermann von Meyer came into possession of the fossil of a single feather impression. The two halves of the small limestone slab containing the impression were

supposed to have been found at the Solnhofen Quarry (Southern Germany) but details of its background never were given adequately. Meyer named the specimen Archaeopteryx lithographica [3]; the genus name meant "ancient wing" while the species name reflected the fact that the particular limestone at the quarry was used for the production of lithographic plates in the printing industry. The specimen made news, because, although the feather looked perfectly modern, it was supposed to have been found in strata of the Jurassic period and therefore 150 million years old. This meant that birds had evolved far earlier than anyone had expected, and, at the time, this was a severe blow to Cuvier's then popular theory of multiple floods. One further detail worth noting was the fact that in a very unusual move the two halves of the slab were sold separately to the Berlin and the Munich museums respectively; normally, the slab and counter-slab are kept together. The agent for the sale of this extremely rare fossil was Dr. Karl Haberlein, medical officer for the district of Pappenheim.

Less than two months later, in 1861, Haberlein had another specimen for sale, but this time it was of the entire creature except for its head. About as big as a pigeon, it was said to have been discovered in the strata of the Jurassic period at the Solnhofen quarry while this time the two halves, slab and counter-slab, were kept together. Haberlein invited museum representatives to see it, but they were not permitted to make notes or drawings; further, by refusing each offer he effectively drove up the price. One observer, M. Witte of Hanover, gave a very complete verbal description to professor Andreas Wagner who had discovered and named a small dinosaur Compsognathus. Wagner recognized from the description what seemed to him to be his Compsognathus but with feathers! He was extremely suspicious, and, in his paper in which he called the new discovery Griphosaurus, added the following warning:

...I must add a few words to ward off Darwinian misinterpretations of our new Saurian. At first glance of Griphosaurus we might certainly form a notion that we had before us an intermediate creature, engaged in a transition from the Saurian to the bird. Darwin and his adherents will probably employ the new discovery as an exceedingly welcome occurrence for the justification of their strange views upon the transformation of the animals. But they will be wrong.[4]

And, of course, Wagner was absolutely right; the Darwinians made it their Rosetta Stone. Haberlein's reaction to Wagner's paper can well be imagined and he resolved to unload the fossil at the next offer. He did not have to wait long, and, while the Germans argued among themselves, "real or forgery", an offer came from England.

Richard Owen, in charge of the British Natural History Museum, read Wagner's description and immediately sent the geologist, George Waterhouse, to Pappenheim where the specimen changed hands for 600 pounds. The dispute now shifted to England. Owen published his description and an accurate engraving of just the slab, not the counter-slab, in 1864 [5]. The fact that it had fully developed feathers classified it as a bird and there were speculations as to whether the head would have had teeth or not; having teeth would place it more centrally between the reptile and the bird and thus be a more perfect confirmation of Darwin's theory. Sure enough, sixteen years later, another Archaeopteryx turned up complete with head and it did have teeth! In the meantime, neither Darwin nor Thomas Huxley could be convinced that the London specimen was a transition. Darwin mentioned it in the 1866 (fourth) edition of his Origin as merely "a strange bird" [6] while Huxley expressed a similar opinion to the Royal Society in 1868 [7]. However, in his classic 1867 paper on the classification of birds [8], Huxley proposed the new taxonomic order Sauropsida for both reptiles and birds thus relating them on paper if not in fact.

The second Archaeopteryx discovery in 1877 was again claimed to have been made at the Solnhofen site and passed through the hands of Karl Haberlein's son, Ernst [9]; this time the enormous sum of thirty-six thousand gold marks was demanded for the prize. Far more than any museum could afford and after four years of negotiations, it was eventually bought by the industrial magnate, Werner Seimens. Seimens then sold it to the Prussian ministry so that it ended up in the Humbolt Museum in 1881. The formal description by professor Dames did not appear until 1884 [10]. The patriotic gesture by Seimens to ensure that the prize did not leave German soil was later rewarded by naming the creature Archaeopteryx siemensii. Later still, the classification name was changed to Archaeopteryx lithographica or, more usually, the Berlin Specimen. Because it is the most complete, photographs of this specimen are shown in practically every school biology textbook as definitive evidence of a transition from one major group to another.

Textbooks sometimes speak of "many other examples" and by this is meant: A poorly preserved specimen discovered in 1956 assigned by Heller as an Archaeopteryx and known as the Maxberg Specimen [11]; it remains in a private collection. A specimen discovered

in 1855 and classified as a pterosaur by the Teyer Museum until 1970 when it was reclassified as an Archaeopteryx by Ostrom; it is referred to as the Haarlem Specimen [12]. A specimen discovered in 1951 and classified as a Compsognathus longipes reclassified by Mayr in 1973 as an Archaeopteryx and known today as the Eichstatt Specimen [13]. The most recent specimen was "discovered" in a private collection and classified by Wellnhofner in 1988 as an Archaeopteryx; it is referred to as the Solnhofen Specimen [14]. It is to be emphasized that none of these last four specimens show feather impressions. More will be said of this later. The great bird expert, Professor Ostrom, writing before the 1988 specimen was assigned said of these latest specimens:

...these specimens are not particularly like modern birds at all. If feather impressions had not been preserved in the London and Berlin specimens, they [the Maxberg, Haarlem and Eichstatt specimens] would never have been identified as birds...notice [they] were all misidentified at first, and the Eichstatt Specimen for 20 years was thought to be a small specimen of the dinosaur Compsognathus. [15].

The six specimens of Archaeopteryx lithographica together with the feather reported by Herman von Meyer, are summarized in Table 1. The first column gives the date on which disclosure was made.

TABLE 1  
Archaeopteryx lithographica

1860	Single feather referred to as von Meyer's.
1861	London Specimen found at Solnhofen.
1877	Berlin Specimen found at Solnhofen.
1956	Maxberg Specimen assigned as <u>Archaeopteryx</u> .
1970	1855 Haarlem Specimen (pterosaur) re-assigned.
1973	1951 Eichstadt <u>Compsognathus</u> re-assigned.
1988	Solnhofen Specimen assigned as <u>Archaeopteryx</u> .

#### THE CHARGE OF FRAUD

Dr. Lee Spetner of the Weizman Institute, Israel, long suspected that the London specimen was a fake and eventually persuaded the British Natural History Museum authorities to let him examine the actual specimen. Museum specimens of the calibre of the Archaeopteryx are securely squirreled away in vaults only accessible to the eye of certified believers; the public sees a mere plaster copy. British scientist, Sir Fred Hoyle had also expressed reservations about the London specimen's authenticity and Dr. Spetner invited him to co-operate in the examination of this fossil. Just before Christmas 1984 the precious artifact was exposed, perhaps for the first time in this century, to the skeptical eye of unbelievers. To forestall charges of fraud, an International Archaeopteryx Conference had been held at Eichstatt just three months earlier where 80 of the faithful had gathered but they were denied the chance to see either the London or the Berlin specimens; the London Specimen was claimed to be "too fragile to travel" and the Berlin Specimen was said to be "in Japan" [16].

During Spetner and Hoyle's examination physical contact was not permitted but a great many photographs were taken using techniques intended to highlight the contours. This was important because the surface upon which the fossil impression lies is three-dimensional; published photographs leave the viewer with the impression that the fossil lies on a two-dimensional plane. The results were most revealing but when it came to publication the ranks and minds of the scientific press were solidly closed! In the end, Hoyle and Spetner and their associates published their findings in a series of photographic articles in The British Journal of Photography [17-20]. The charges led to counter-charges by Alan Charig and others of the British Museum [21]. In the meantime, the public press reminded of the Piltdown affair at the same museum in 1953, smelled the makings of another scandal and eagerly fanned the flames of contention. Sir Fred Hoyle quickly published a little book containing some very interesting photographs and documentation of the charges and counter-charges [22]. Finally, in late 1987, the museum put their most famous fossil on display with a list of rebuttals to the charges of hoax in an attempt to regain the public confidence. From that day to this the public had heard nothing more of the debacle.

Hoyle and Spetner concluded that the London Specimen was actually a genuine fossil of the Compsognathus, an extinct reptile, to which had been added the impressions of modern feathers. Hoyle suggested that the forgers had spread a mixture of finely ground limestone and gum arabic thinly across the wing and tail areas then pressed modern

feathers into this mixture. The feathers were removed after the cement had completely hardened [23]. They also suggested that the first discovery, the von Meyer specimen, had been produced in the same way and pointed out that the texture of the slab and counter-slab were not the same as would be expected from a genuine fossil. It would seem that this would provide a very good reason for the forgers to have sold the two halves to separate museums [24]. Fossil forgery was not a new thing to the enterprising quarry owners of Solnhofen; Wendt shows for example that a fossil forgery business had flourished at Ohningen just 120 miles from Solnhofen for over a century [25].

The London Specimen is unique in having an oversized furcula or wish-bone which is found in birds but not usually in reptiles. Indeed, it is the feather impressions and the furcula which give this fossil its avian status. However, in a paper communicated to the Royal Society in 1868, T.H. Huxley not only doubted that it was a furcula but declared it to be "conspicuous" and "bouleversement" or up-side-down. He then gleefully showed how this had completely confused his rival, the great Richard Owen in his description of the fossil [26]. In the same paper Huxley concluded:

In fact, in its form, and strength relatively to the shoulder girdle, the so-called "furculum" appears to me to be the greatest osteological difficulty presented by Archaeopteryx. [27]

Hoyle's suspicions regarding the furcula centered upon the corresponding cavity in the counter-slab which appears to be insufficient to contain the prominent furcula. He suggested that the forgers had added a crude furcula then attempted to excavate a cavity in the counter-slab to get it to fit [28]. However, a recent profile analysis has shown that there is, in fact, a perfect fit but detailed discussion of the feathers, furcula and other bones from all specimens will follow later. At this point a list of the principal evidences for hoax and the museum rebuttals will be given:

a)The tail lies at the bottom of a depression in the surface of the slab and there is no corresponding raised area in the counter-slab. Hoyle maintained that when originally split the tail lay beneath the surface of the slab but the forgers excavated around the tail bone, back-filled part of the way with a cement of finely ground limestone and gum arabic, then set feathers in place so as to leave the impressions. Hoyle mistakenly refers to the tail area as "the tail feather" but of course the impressions consist of a number of feathers, two to each bone in the vertebrae. The museum maintains that it was scientists at the museum who removed some rock from the slab to reveal the tail feathers. However, if this was the case then it must have been carried out by Richard Owen's staff prior to his 1864 publication [5]. This contains an excellent engraving of the slab complete with every tail feather as it is today but Owen mentioned nothing of any excavation work.

b)The feather impressions mostly appear on the slab and not on the counter-slab except for one tiny piece described by Hoyle as 'gum-like'; when analysed it showed traces of foreign substances. Hoyle's photograph of this piece showed that it has feather impressions, but the museum's explanation fails to mention this and simply says that the foreign substances probably came from mould-making or the sealer which has been applied to the surface. Neither explanation would account for the feather impressions. Hoyle's supposition that the thin layer of 'cement' spread on the counter-slab by the forgers did not 'take' but fell off except for the one isolated 'gum-like' piece appears to be the more probable explanation [29].

c)The museum granted Spetner two very small samples of the fossil surface; one from the "wing" area and the other as a control remote from the "wing" area. A scanning electron microscope analysis carried out at the Weizman Institute showed that the control sample was clean crystalline limestone as one would expect but that from the "wing" area was amorphous; X-ray luminescence analysis revealed that it had a strange composition. Suspicions that it was indeed the glue and limestone mixture which had been suggested, were close to being confirmed. Yet another sample was necessary to be sure the first sample was truly representative and not an artifact. The museum refused all further testing [30].

d)Hoyle and his associates (but not Spetner) suggested that Richard Owen knew that the fossil was a forgery when he purchased it [20]. Hoyle argued that Owen was a creationist (untrue) and his intention was to expose it as a fraud after Darwin had accepted it and thus discredit Darwin and especially Huxley and the theory of evolution. However, this was an unfortunate piece of speculation which Gould has taken great delight in showing to be totally untrue [31].

The museum's prime evidences for the fossil being genuine are:

e) There are hairline cracks in the feathered areas which match exactly on the slab and the counter-slab. These cracks are filled with natural crystals and so must have been in the slab before it was split open. Spetner and others have pointed out that when cracks in a wall are plastered over they re-appear as the house settles. The London specimen has indeed received much pounding by the hammer during the past century and removing of the "brain-case" was only one instance when cracks had ample opportunity to propagate through the thin layer of forger's cement.

f) Dendritic patterns, some of which match exactly on the slab and counter-slab, appear to overlie the feather impressions. Dendrites are tree-like growths of dark mineral crystals and take centuries to form. Dr. Spetner shows from his photographs that the dendritic pattern is genuine but does not overlie the feathered area [30] while in private correspondence he more forcefully states that "the matching dendrite claim is simply fraudulent" [31].

So much for the London specimen and the observations of those who have actually examined it in contrast to those defenders of the faith, such as Gould [32], who write from a more distant ivory tower.

### THE BERLIN SPECIMEN

The Berlin *Archaeopteryx*, discovered in 1877, is the most perfect of all the specimens since it not only has feathers on the wings and tail but is complete with the head having teeth and has both legs and both feet. The public was first made aware of this specimen in an engraving prepared from a drawing by Professors Steinmann and Doderlein and appeared in Karl Zittel's prestigious *Handbuch der Palaeontologie* for 1887 [33]. The engraving was labeled "nach dem Berliner skelet..." (after the Berlin skeleton...) and consisted of an imaginary composite of the London and Berlin specimens including the up-side-down furcula. The illustration appeared in countless textbooks and led the public to believe the evidence to be more convincing than was actually the case. The complete engraving is shown in Figure 1 and the furcula ('U'-shaped object top, center) is labeled 'Cl' for clavicle which is believed to be the reptile counterpart of the bird's furcula. Figure 2 is a recent photograph of the same specimen and there is no sign of a furcula. Yet, as we shall see, there is worse to come and the discerning reader may suspect that this, most famous of all fossils, is another forgery.

Professor C.H. Hurst personally examined and photographed the Berlin Specimen in 1893 and observed that there were serious discrepancies between the engraving and the actual specimen [34]. The furcula has already been mentioned. The principal discrepancy occurred in the wing area, and the engraving and his photograph of the left-wing are reproduced in Figures 3 and 4. Hurst's photograph of the wing area was genuine and identical to the corresponding part of a photograph of the entire specimen published by Carl Vogt sometime shortly after its discovery in 1877. Hurst claimed that the original drawing was deliberately falsified to make it appear that the primary quill feathers originated in the 'arm' and not in the 'hand'. He invited his readers to place a straight edge on the photograph and observe that the fourth primary feather is straight. Incredibly, modern photographs now show the wing feathers to be 'bent' exactly as in the engraving. Comparison between an early and a modern photograph may be made between Figures 2 and 4 but Figures 3 and 4 show the difference more clearly. The first three distal feathers curve very slightly backwards towards the base of the fourth and the remaining primary feathers curve slightly forwards towards the same point; all these primary feathers thus originate in the manus or hand. In contrast, the engraving shows that all seven primary quills are bent backwards, some almost 40 degrees which has increased their length and doubled it in the case of the third quill.

Professor Hurst also pointed out that not only was the engraving unfaithful to the facts but argued that strongly curved feathers are useless for flight. Hurst also showed that in his detailed description of the specimen, Dames [10, p.138], states that the primary quills were attached to the longest finger [35]. The publication of Dr. Hurst's criticism of the Berlin Specimen led to a lengthy rebuttal paper read to the British Association by Dr. W.P. Pycraft of the British Museum [36]. Pycraft defended the fossil on the basis of Hurst's photograph rather than the engraving and rightly pointed out that straight primary feathers could be expected to originate from the fingers. This is true of most modern birds but the engraving and every modern photograph of the Berlin wing, including Heilmann's dated 1923 [37], now show that the primary feathers are bent and originate in the ulna or fore-arm region. The change from straight to bent feathers in the photographs evidently took place sometime between 1893 and 1923.

In the same paper Professor Hurst made another observation that "these fingers lie not in the wing at all, but upon its feather-clad surface" (his emphasis) [38]. He concluded that the Archaeopteryx was a winged quadruped which used its fingers for climbing. While few claim it to be a quadruped there has been much speculation as to whether the creature could fly or was it simply a climber? Recalling that the surface of the slab is actually in three dimensions and not two, then since the bones are exposed, there is little option but for the feather impressions to appear to lie beneath them. Without removing the bones there can be no proof that they do but it is self-evident that if the situation were reversed with the bones beneath the feather impressions then the bones would not be seen at all. Any forger with his wits about him would be aware of this and arrange for the wing to appear to lay beneath the arm bones in the following way: The wing area adjacent to the 'arm' and 'hand' was masked off with wax and the surface gently etched away with acid to remove perhaps 2 mm. This was then partially back-filled with the comminuted limestone/gum arabic mixture and modern feathers pressed in place. No clumsy hammering and risk of damage would be involved.

It is now almost a century since Professor Hurst published his criticisms based upon personal observations of both the London [39] and Berlin specimens. It may be wondered why this information is not more widely known. The scientific establishment has been virtually dominated by biologists ever since Darwin's day and a kind of censorship of any work critical of evolution has been in effect throughout this time. Hurst had published his work in a scholarly journal offering a balanced airing of contrary opinions; the journal was short-lived (from 1892 to 1899) and is seldom found in library collections today. Similarly, because of the nature of Hoyle and Spetner's findings, these were not found acceptable to the mainline biological journals and they were obliged to report them in The British Journal of Photography.

### IS THE ARCHAEOPTERYX REALLY A BIRD?

Having seen some of the short-comings of both the London and Berlin specimens we will now briefly survey the various features of all the specimens bearing in mind Spetner and Hoyle's contention that the London Specimen is a fraudulently modified Compsognathus. First, we will examine the two features which give the creature its status as a bird i.e. the feathers and the furcula.

**THE FEATHERS.** Impressions of modern feathers only appear on the London and Berlin specimens and only on the tail and in the wing areas. Hurst had remarked on the marvelous state of preservation of the feather impressions saying, "even the barbules of some of the quills are recognizable" [40]. It may be added that there are no other examples of feathers having been preserved in such detail in the fossil record. One very recent case reported in 1988 from Spain [41] is of a single, half-inch long feather but this had been carbonized. That the preservation of such microscopic detail should occur in the two specimens already shrouded in suspicion is simply what one might expect from a forgery where the forgers had little choice but to use modern feathers. It raises an interesting question concerning the kind of detail present in the wing areas of the Berlin Specimen after its apparent modification about a century ago? As far as specimens assigned more recently to the status of Archaeopteryx are concerned, the popular accounts typically say that "feather impressions are distinct" [42] but, in fact, the investigator's statements say, "These features are interpreted as imprints of feather shafts" [43]. Quite a different thing where for example the "feather shaft impressions" may have been produced by quills and not feathers. Moreover, there is not a hint of a feather or feather shaft impression near any of the tails of the Maxberg, Haarlem, or Solnhofen specimens; Wellnhofer [14] claims there are feather impressions in the tail area of the Eichstatt specimen but Ostrom denies this.

**THE FURCULA.** While no one is quite sure of the function of the furcula, most evolutionary biologists believe that it came about by the fusion of the clavicles or collar-bones in the ancestor of the bird. This has led to much speculation among armchair scientists who may never have examined the actual specimens and it would seem better to accept with caution the arguments of those who have. John Ostrom is probably the world's greatest expert on birds and has personally examined every one of the Archaeopteryx specimens. We will be referring to his 1975/6 papers [15,44] which can probably be regarded as the definitive work. Ostrom describes the furcula of the London specimen as a "boomerang" [45] while even to the untutored eye it is nothing like the delicate wish-bone found in any chicken; this should be cause for question but, so far, it has seemingly been accepted on faith alone. Ostrom maintains that the Berlin Specimen has fragments of bone which many claim as the furcula "although it cannot be proved" and expresses surprise that there is no trace of a furcula in the otherwise well-preserved Eichstatt Specimen [46]. Ostrom also maintains that "a similar bone is partially preserved in the two slabs of the Maxberg Specimen" [47]. This specimen is in

the hands of a private collector and photographs of the furcula have not been published; in private correspondence with the author, professor Ostrom has provided a photograph of the alleged furcula but it is far from convincing while he admits that Heller [11] failed to even mention this vital detail. Finally, Ostrom points out that the presence of a furcula seems paradoxical together with the apparent absence of a sternum in every one of the Archaeopteryx specimens [48]. Moreover, there are many little avian details which are entirely absent in all these specimens such as the hypocleideum on the furcula or the external cnemial (shin) crest on the tibia [49].

#### EVIDENCES FOR THE COMPSOGNATHUS

Over the years opinions have shifted back and forth between the Archaeopteryx being a feathered reptile to it being a bird with reptile features; the latter view prevails today. Among the claims for avian status has been "the perching feet" and "the orientation of the pubis" (the pubis bone of the birds faces backwards, that of the dinosaurians face forwards). Interestingly, and perhaps uniquely among dinosaurs, the Compsognathus is said to have had a backward facing pubis like that of a bird [50]. Ostrom refers to the classic work of Heilmann [37] who in 1926 gave an impressive list of the similarities between the Archaeopteryx on the one hand and the coelurosaurian theropods on the other. However, Heilmann then dismissed the theropod connection because it was believed that this branch of reptiles did not possess a clavicle; Ostrom cites more recent work to show that some theropods do have a clavicle thus removing this negative evidence. After spending half a lifetime studying the Archaeopteryx Ostrom concludes his 1976 paper with:

Were it not for those remarkable feather imprints...both specimens [the London and Berlin] would be identified unquestionably as coelurosaurian theropods...there is only one skeletal feature that is not currently known in any theropod specimen. This single feature is the fusion of the clavicles into a furcula" [51].

And in his 1975 paper, Ostrom is more specific:

The presumed bird-like orientation of the pubis in the Berlin Specimen is probably not correct, but due to post-mortem displacement. The bird-like feet and hind-legs are equally theropodous and all of the other so-called bird-like features (hands, arms, pelvis, and skull) are actually more like those of theropod dinosaurs than they are bird-like" [52].

The list of similarities is impressive there being for example, nine major points of similarity between the head of the Archaeopteryx and that of the Compsognathus alone [53]. But then this is precisely what would be expected if the Archaeopteryx is nothing more than a modified Compsognathus. Heilmann's restoration of the Compsognathus is shown in Figure 5.

#### CONCLUSION

In this paper we have not been concerned with the unlikely possibility that the Archaeopteryx was a strange mosaic creature like Australia's duck-billed platypus. The concern has been with fraud: its motive seems to have been monetary gain, the result has been to provide evidence for a theory. When all the published facts regarding the Archaeopteryx are brought forward, any unbiased jury would find it extremely difficult not to conclude that both the London and Berlin specimens were fraudulent. The more recent "discoveries" are seemingly an attempt to restore confidence in an oft-told myth and have been carried out by mere re-classification of the same kind of fossil used for the hoax; the feather evidence, like Percival Lowell's 700 canals on Mars, is more in the eye of faith than it is in fact. Professor Ostrom, who has examined every specimen confesses that only the London and Berlin specimens contain clear feather impressions while the Eichstatt tail has a "plume" but no evidence of feathers. The London specimen is the only one having a clearly defined feature said to be a furcula and, while Ostrom claims the Maxberg specimen has a furcula, this is not at all convincing. Even if an undoubted furcula were discovered in another specimen, this would only tend to confirm that the furcula in the London specimen was genuine. However, it would not remove the suspicion of fraud because it seems likely that the Compsognathus itself may have had fused clavicles. Finally, it is surely incumbent upon the paleontologist to provide convincing explanations for: a) the change from straight feather impressions to the unlikely bent feather impressions in the Berlin specimen and b) why primary feathers, which are modern in every respect, attach to the ulna instead of the manus as in modern birds? Until such explanations are forthcoming the suspicion of fraud will remain.

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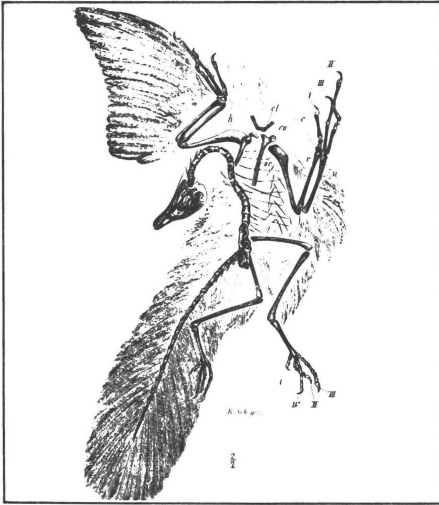


FIGURE 1.  
Engraving after the Steinmann-Doderlein drawing which appeared about 1884. The right-wing was omitted. Cl=furcula.

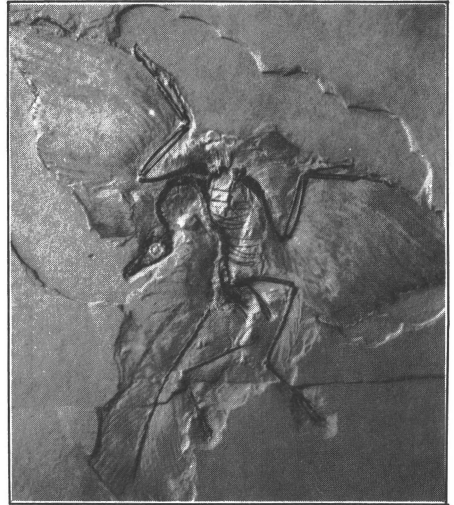


FIGURE 2.  
Photograph of a plaster-cast of the specimen as it is today and as it appears in text-books.



FIGURE 3.  
Detail of the 1884 engraving showing the Left-wing. h = humerus. Radius and ulna = 'forearm'. Claws = the 'hand'.

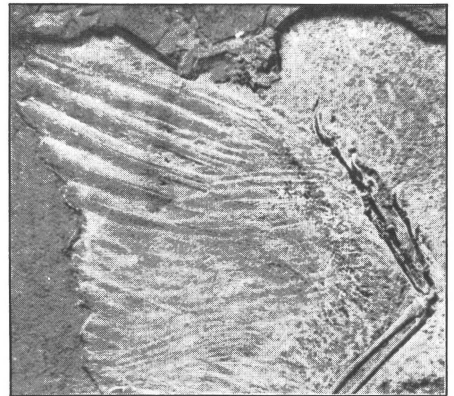


FIGURE 4.  
Professor Hurst's 1893 photograph of the left-wing. Note the primary feathers at the top/left are virtually straight.



FIGURE 5.  
Restoration of *Compsognathus longipes* by Gerhard Heilmann [37] p.167. About the size of a domestic cat.

## DISCUSSION

Based mainly on the research of Hoyle and Spetner and the 1975/1976 opinion of J. H. Ostrom, Mr. Taylor concludes that the specimens of Archaeopteryx are hoaxes, and actually are specimens of Compsognathus. The argument, however, fails in many instances, for example the following:

As organisms turn into fossils, the minerals exactly around and inside the fossil usually become harder than the surroundings, because of the organic content in the buried animal or plant. That actually is one of the main reasons why we can find fossils - that the minerals in and close by the organisms get another structure than the surrounding material. Therefore, it is very possible that the minerals in the feather imprints have another structure and composition than the surroundings. It would be more peculiar if it was not so.

Furthermore, scientists have prepared this fossil for more than 100 years, and it would not be surprising if pieces of the slabs have been scraped away.

Moreover, there is no reason why the slab and counter slab need to have the same texture (as seen from the work of fossiliferous limestone). Also the 1884 picture does not necessarily have to look exactly the 1893 photograph, since scientists in working those days sometimes did not or could not make drawings/engravings that looked exactly as the original.

If Mr. Taylor examine the recent research surrounding this fossil, he will find that there is no reason to classify Archaeopteryx as Compsognathus (Hecht, et al, 1985; Haubitz, et al, 1988). Archaeopteryx has been carefully described as a diving bird using it's wings as the propelling agent, thus offering evidence as to why Archaeopteryx has been so carefully preserved in the sediments (Duffet, 1983). Archaeopteryx, does not fit in with evolutionary theory and the descriptions become more and more bird-like (Hecht, et al, 1985; Haubitz, et al, 1988).

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Mats Molen, M.S.  
Umea, Sweden

Mr. Taylor has done a good job researching the status of the fossil Archaeopteryx. In particular, I commend him on his original findings regarding the Berlin specimen, which were unknown to me until he wrote me about it. He has written a good expository paper. Except for a few minor points of presentation, which I omit for lack of space, I offer the following remark:

Mr. Taylor said that the "claims that the specimen is a hoax have been examined and substantiated." As one who has been in the center of this controversy from the beginning, I can only say that I wish this statement were true, but unfortunately it is not. Upon examining about a milligram of material from a feathered area in the fossil and comparing it to a similar amount off the feathered area, we have found evidence pointing to a forgery. Had our findings been repeated on several more samples from the feathered and nonfeathered areas, the suspicion of a hoax would have been clearly established. As it is, however, the museum contends that the amorphous nature of feathered material is an artifact explainable by preservatives that they have put on the fossil. The clean appearance of the control sample could perhaps be explained by saying that the preservative did not get to the region from which that material was taken. An unequivocal substantiation of the suspicious of a hoax can only be arrived at with a similar examination of several samples from different places in the fossil. The British Museum, however, refuses to grant us any more material and refuses to make any tests themselves. Their attitude is frustrating and is cause for further suspicion, but it prevents us from coming to a unequivocal conclusion.

L.M. Spetner, Ph.D.  
Trenton, New Jersey

This paper does not do justice to the efforts of the British Museum (Natural History) to respond to the charges of forgery. The definitive paper by Charig et al, (1986) receives only a brief mention, but it deserves to be repeatedly consulted in assessing the various claims. For example, the museum's prime evidences for the fossil being genuine are said to be twofold:

1) Matching hairline cracks containing natural crystals. The response to Spetner, cited by Mr. Taylor misses the point here. The presence of natural crystalline material in the cracks shows that no surface covering has been deposited by a forger.

2) Matching dendritic patterns overlies the feather impressions. Charig et al (1986) have published photographs (Figure 3) showing a specific example. Hard evidence like this deserves more serious attention than that given by the author.

Mr. Taylor concludes that the skeletons are those of Compsognathus. There are a number of research papers which show that this is not the case, but their significance is not explored by the author. Palaeontological evidence must be addressed if the charge of forgery is to be seriously considered. The interpretations of Duffet, in his monograph Archaeopteryx Lithographica Reconsidered (Biblical Creation Society, 1983), is strongly recommended as an alternative to Mr. Taylor's approach.

The charge of forgery requires that the von Meyer feather be a case of "testing the market". Judging from the comments in this paper, substantial evidence to support this idea appears to be lacking.

David J. Tyler, M.S.  
Cheshire, England

Mr. Taylor's paper lacks both original research and a convincing argument for the artificiality of Archaeopteryx feathers. By my count, the author provides 15 evidences of forgery. Most of them can be adequately explained by the more parsimonious theory of authenticity as follows:

- I. Mr. Taylor's primary claim is that an 1877 photograph of the Berlin specimen differs from all subsequent photographs, thus documenting a distinct (artificial) change in the feather direction. In point of fact, the photographs the author showed at the conference demonstrate that his claim is incorrect. All the features of later photographs can be found in the photograph of 1877.
- II. 2 of Mr. Taylor's evidences fail to cast any true suspicion on the specimens at all: (2) In spite of their age, the Archaeopteryx feathers happen to be some of the best-preserved feathers in the fossil record. This would not surprise a paleontologist who learns that all the specimens were from the Solenhofen limestone. The Solenhofen is one of the most famous "lagerstätten" in the world, containing some of the best fossils of a wide variety of organisms; and (3) Andreas Wagner, publishing in 1862, expressed serious doubts about the specimen. Wagner had done this without seeing the fossil. His objections seem to be entirely motivated by ideology, not observation.
- III. 3 'evidences' are very common practices in 19th century paleontology, and lead us to be suspicious only from the perspective of the practices of 20th century paleontology: (4) Haberlein's desire to receive top dollar for his specimens; (5) Haberlein sold the Von Meyer slab and counterslab separately (for another example of how slabs and counterslabs were viewed in the past see S.J. Gould's *Wonderful Life*); and (6) Zittel's figure drawing alters (in fact, 'improves') the specimen.
- IV. 3 can be adequately answered by a hypothesis of authenticity: (7) The London specimen's tail being in a low area on the slab without the corresponding raised area on the counterslab could simply be due to excavation of rock in the process of fossil preparation; (8) The feather-impressed, non-pure, gum-like piece on the counterslab of the London specimen might be the remnant of a cast taken of the specimen sometime in the past 130 years or so; and (9) The non-pure nature of the slab in the area of the wing might also be a result of impregnating chemicals from casting processes carried out over the last century or so.
- V. 4 are claims given without sufficient data to evaluate their veracity: (10) The London specimen's furcula is 'strange'; (11) (Huxley's argument) The London specimen's furcula is 'up-side-down' and too large; (12) the Von Meyer slab is of a different texture than its counterslab; and (13) Darwin and Huxley both rejected the transitional nature of Archaeopteryx.
- VI. 2 would be unexplained coincidences if the specimens were authentic, but are weak evidences because of their circumstantial nature: (14) the timing of the discoveries with the creation of the theories which needed them as proof; and (15) in the region where the fossils were found at the time of their discovery, fossil forgery is known to have been a common industry.

On the other hand, the two evidences for the authenticity of the London specimen given by the British Museum appear to have substantial merit: A) Unlike Mr. Taylor claims, in the photograph the author himself showed at the conference, dendrites do appear to overlie both the wing area and the adjacent slab and B) although, as Mr. Taylor claims, cracks can propagate through a specimen and overlying plaster as the specimen is being prepared, the British Museum claims that

'natural crystals' can be found in the crack. In my experience, 'natural crystals' do not form in cracks after excavation.

Mr. Taylor's paper not only lacks compelling evidence to demonstrate the artificiality of Archaeopteryx feather impressions, but presents sufficient evidence to argue for their authenticity.

Kurt P. Wise, Ph.D.  
Dayton, Tennessee

#### CLOSURE

I would like to express thanks to Mr. Mats Molen, Dr. Lee Spetner, Mr. David Tyler, and especially Dr. Kurt Wise for taking the time to respond to my paper. While none of us, including Dr. Wise, will ever have the opportunity to carry out original research work on the precious specimens, my thesis is based upon those who have and quotes by chapter and verse have been given. With the single exception of Dr. Spetner, who has examined the London specimen and has left convinced that it is a hoax, the remarks of the other respondents fall into the category of arm-chair speculation. In answer to Mr. Molen objections, firstly, we would expect both genuine fossil and a fake to have different textures from their matrix so this is not definitive. However, the fact that "shrinkage cracks" occur only in the London and Berlin specimens and then only in those areas which it is believed have been tampered with and not, for example, around the head, set these specimens apart for suspicion. Secondly, Heilmann (Ref. 37) who did examine the specimens, gives an exhaustive list of characteristics which identifies the *Archaeopteryx* with the *Compsognathus* and makes the claims of Hecht *et al* that it was a diving bird look like a poor attempt to explain away a creature having modern feathers but no sternum. Duffet mentioned Heilmann's work but he seems to have missed the significance of:

- a) The unusual number of similarities with the *Compsognathus*.
- b) The reclassifications of more recent specimens including that of the Eichstadt *Compsognathus*.

Mr. Tyler focussed upon the matching hairline cracks and the matching dendrites in slab and counter-slab of the London specimen and it can only be assumed that my treatment of these objections given in points (e) and (f) was insufficient. That hair-line cracks perpendicular to the cleavage plane undoubtedly existed for centuries during which time mineral crystals formed within them. After cleavage to expose the fossil, it is proposed that a thin layer of cement spread over the surface would initially cover the cracks like snow over a crevasse. Elementary rules of fracture mechanics tell us that the cracks would act as stress raisers and with time and tensile stresses, these cracks would propagate through the thin layer of cement. This is exactly what happens with re-plastered walls. As far as the dendrite claim is concerned, I suggest we accept the observations of Dr. Spetner who points out that the claims of the British Museum are "simply fraudulent". It should be borne in mind that we shall never see, nor has the public ever seen, the slab counter-slab on display together.

Dr. Wise has diligently counted 15 evidences of forgery in my paper without evidence of having actually read it! This is not only cause for suspicion regarding the authenticity of the two specimens but also suggests that this reader may be blinded by commitment to another faith. Furthermore, Dr. Wise has missed entirely the most serious claim. Does he know the attachment point of primary feathers in the modern bird? They attach to the manus or hand whereas in today's photographs of the Berlin specimen they are bent, some 40 degrees, and attach to the ulna. Apart from seriously bent feathers being useless for flight, both the engraving of 1884 and modern photographs show these features very clearly. In contrast, the photographs of Hurst (1893) and another taken a few years earlier by Carl Vogt, show the primary feathers are straight and originate in the manus area. And this is not my opinion but that of Professor Dames who described the specimen in 1884. Then again, in 1894, Dr. Pyecraft of the British Museum built a case based upon the straight primary feathers of the Berlin specimen originating from the manus and provided detailed drawings showing how modern feathers attach to the same area. All this was carefully documented in my paper and every relevant illustration reproduced during the lecture. Dr. Wise's claim (b), that the London and Berlin specimens have the best preserved feathers because they originated in the Solnhofen limestone utterly fails to explain why the Maxberg specimen, found at the London specimen site, or the Eichstadt and Solnhofen specimens, found at the Berlin specimen site do not contain even the vestige of a feather. The argument simply heaps more suspicion upon the already suspect specimens. I trust discerning readers will see through the remaining equally tendentious arguments without space having to be taken to so in this reply.

Ian Taylor, B.S.

