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Identification by circumstantial evidence

The assumedly mortal remains of Queen Editha (Eadgyth) (910–946 AD), wife of Otto the Great (912–973 AD) were subject of identification. The aim of the multi disciplinary investigations of an international research team was to test the hypothesis that the coffin indeed contained the skeletal remains of Queen Editha, as an inscription on its lid states. Biographical data of the historic Editha have been conveyed, but *ante mortem* information that goes beyond her civil status, similar to what is needed to identify a missing person in legal medicine, are missing. A firm identification, instead, requires the exact agreement of personal markers by checking *ante mortem* against *post mortem* features. The following biographic data are available: **sex** (female), **age at death** (36 years) and **origin** (Wessex, England).

The lack of complete bone structures of the individual such as the feet, the right hip bone, parts of her hands and pectoral girdle as well as the vertebrae and ribs are especially noticeable. Of the skull, only the maxilla is preserved. As curios appears the presence of all teeth of the mandible, while the jaw bone itself is lacking. An explanation of the unusual missing of bones may be the medieval trade with relics. The bad structural preservation of bones and teeth could cohere with the funeral traditions: in public areas of the church chalk was used to reduce the smell of the dead bodies.

The identification of unknown persons is one of the most difficult tasks in forensic sciences, especially if there is no information about inherent or acquired features and no soft tissue preservation. The incomplete and fragmentary skeletal remains from the lead coffin are in a bad condition but certainly represent the remains of only **one individual**. The reconstruction of a genetic profile failed because of the disadvantageous preservation. Therefore, matching with first-degree relatives is impossible. The application of descriptive morphological and metrical methods provided distinct evidence of a **female**. A variety of age-determine methods argue for an **age at death** of **30 to 40 years**. Furthermore, an **accessory facet** (Poirier's facet, rider's facet) at the head of the left femur supports the identity of Editha.

Strontium (Sr) and oxygen (O) isotope analyses were carried out at the Universities of Mainz and Bristol to identify the place of Edithas origin. Sr isotopes reflect the geological condition of the area in which a person grew up. Enamel from the tooth crowns of two different molars that mineralize a) between birth and the 3rd year of life and b) between the 2nd and the 7th year of life were investigated . Sr isotope ratios of both teeth do not match the

local values for Magdeburg, but reflect chalky soils as they are common in southern England. The data are consistent with local values from the Winchester area. Although this range of isotope ratios can also occur in other areas, in its overall context the result has to be judged as a strong argument for Editha's identity. O isotope analysis that was carried out in Bristol supports the Sr isotope information. The O isotope ratios confirm southern England as area of origin.

Carbon (C) and nitrogen (N) isotope ratios of bone collagen reflect a person's diet during his or her lifetime. The results mirror a high quality nutrition, which was rich in animal-derived proteins and possibly also fish. According to her diet, "Editha" lies at the upper end of the data cluster of the urban upper class, but differs significantly from the members of the monastic communities that were analyzed in comparison.

Using microscopic techniques it was possible to detect **markers of "stress"** that refer to weaning (**2–3 years**) and nutritional deficiencies or/and infectious diseases **in adolescence**. In addition, only a small dental caries lesion was detectable in the micro-CT as well as a periodontitis in the upper yaw. There is no other skeletal evidence of diseases or injuries. The cause of death remains unknown. Even contemporary sources do not relate to a specific disease or affliction. The reconstructed body height of **157 cm ± 3.5 cm** was calculated by the measure of the left humerus and radius. Moreover, the hair samples recovered from the coffin were identified as animal and human.

Because molecular genetics analyses of the presumed mortal remains of the historic "Editha" were unsuccessful due to the bad state of preservation, the matching of the skeletal remains in the lead coffin and the real queen can only be based on circumstantial evidence. In their entirety, the biological traits confirm the historical sources and do not include a single criterion for exclusion. Like the numerous additional and independent evidence such as the place of burial, the inscription on the coffin as well as the exceptional quality of the recovered textile remains, the results of the anthropological investigations fit into the chain of evidence and consolidate facts that are otherwise improvable. Despite the so far inconsistent absolute dating (^{14}C) there is no doubt about the identification of the human remains from the Magdeburg cathedral as those of the presumed Queen Editha.

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