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Three cases of crania with sharp-force traumas excavated at the Japanese castle sites

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Abstract Human-induced traumas seen on human skeletal remains can indicate information that are not preserved in written records. In this paper, three crania with sharp-force traumas excavated at the Japanese castle sites are analyzed to infer from the trauma what could have happened and how the crania have been preserved. Three crania excavated at the Kasai castle site in Tokyo, the Oda castle site in Ibaraki Prefecture, and the Okayama castle site in Okayama Prefecture were found to have the following features in common: 1) These crania were discovered in the undisturbed environment of a moat or a ditch. 2) They were found in an extremely well-preserved condition, but only the crania were found, while their mandibles and the cervical vertebrae were missing. 3) Traumas caused by sharp edged tools were observed on them. 4) The blows that caused these traumas were inflicted from behind the head. 5) There is a high probability that the victim died in battle or was executed. The interpretations are as follows: 1) The head was exposed until the soft tissue decayed, and then the cranium fell into a moat or a ditch. 2) The cervical vertebrae and mandible may have been removed as part of some ritual, and the cranium was sunk into a moat or ditch. Reports of new cases are desired for further inferences.
Key Words: Japanese castle, human skeletal remains, sharp-force trauma

Introduction

In the fields of physical anthropology and forensic anthropology, human-induced traumas found in human skeletal remains are seen as objective evidence of interpersonal violence (Boylston, 2000; Williamson *et al.*, 2003). In particular, those in ancient human skeletal remains can indicate methods of battle, customs, societal conditions, and so forth that are not preserved in written records (Suzuki, 1956; Dodo *et al.*, 2008; Sakaue, 2016).

In the main land of Japan, archaeological sites of the castles have been discovered, where the human skeletal remains rarely have been excavated. Among some of them, the human-induced traumas were found and reported in human skeletal remains (Baba *et al.*, 1987; Nagaoka and Abe, 2007; Dodo *et al.*, 2008). It is not surprising that there could be traumatized skeletal remains of humans who had been engaged in battle because the Japanese castles were usually used as residences or military posts.

Among the human skeletal remains previously excavated from the castle sites, there have been three cases in which crania with sharp-force traumas and peculiar preserved conditions were found. Nevertheless, so far, there has been no research discussing the unique characteristics of these findings or what they may represent. Therefore, in this research these three cases of cranial trauma are analyzed in detail to infer the possibilities of what could have happened.

Materials and Methods

Three crania excavated at the Kasai castle site in Katsushika-ku, Tokyo, the Oda castle site in Tukuba City, Ibaraki Prefecture, and the Okayama castle site in Okayama City, Okayama

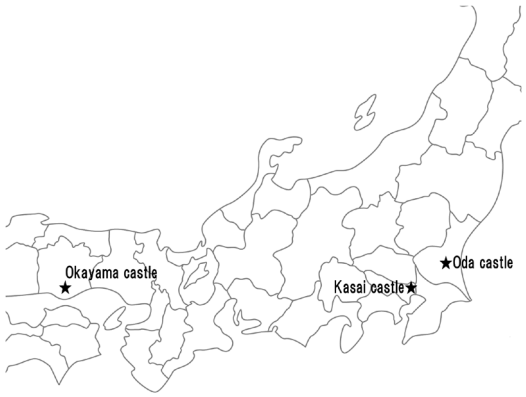

Fig. 1. Locations of the Kasai Castle site, the Oda Castle site, and the Okayama Castle site.

Prefecture were examined (see Figure 1).

The Kasai castle was a "castle on the plains" that was constructed during the Sengoku period in the 15th century, and the site was often a battleground, particularly known for "the battle of Konodai" fought in 1538 (Taniguchi, 2009). It was destroyed during Hideyoshi Toyotomi's siege of Odawara in 1590 and thereafter deserted. The sites of the Kasai castle was the subject of a 1976 report in which human skeletal remains were excavated from the bottom of the remains of an outer moat. A cranium was discovered and some sharp-force traumas were found in temporal and occipital bones of this cranium, suspected to be an injury from a decapitation (Hiramoto, 1976). This specimen is currently stored in the collection of the "Katsushika-ku Museum of History and Astronomy."

The Oda castle was also a "castle on the plains" said to have been constructed during the Kamakura era, with many battles fought over this castle during the Sengoku period (Omaru, 1979). In 1602, its lord went absent and it became deserted. The sites of the Oda castle have been archeologically survayed on multiple occasions, and human skeletal remains were excavated during the 59th excavation reported in 2012. The human skeletal remains were excavated from the bottom of an inner moat. Only a cranium was found, lacking a mandible and with the left facial region damaged. A part of a femur was also excavated, suspected to belong to a different individual because it was found from another location in this site (about 100 m in a straight line from the cranium, in an outer moat dug into a mound). It was reported that sharp-force trauma was found on the cranium (Hirose and Ishikawa, 2012). The specimen is currently stored in the Tsukuba City Board of Education in Tsukuba Prefecture.

The Okayama castle was a "castle on a hill in the plains" constructed during the late Muromachi era. It has been in use from the Sengoku period until the Edo period, but no battles were fought in it other than the Okayama air raid of 1945 (Kojima *et al.*, 2019). The archaeological site at the "Ninomaru" (residential area of the lord) of the Okayama castle, were reported in 2019. A cranium with sharp-force trauma was excavated from the bottom of "ditch 15," which had a width of 4 m and a depth of 0.7 m. No other human skeletal remain have been excavated from this sites. On the basis of archaeological remains and stratigraphy, it is assumed that this ditch was built around the end of the 16th century. Sharp-force trauma was found in one place on the cranium, and the characteristics of this injury could not be attributed to decapitation (Sakaue, 2019). The specimen is currently stored in the Okayama Prefectural Board of Education.

In this paper, the sexes of individuals were estimated from their cranial features (Sakaue and Adachi, 2009). The age at death of specimens were inferred from cranial suture closure (Meindle and Lovejoy, 1985; Sakaue, 2015). A sharp force trauma made by a sharp-edge instrument was identified as a fracture with "linearity", "a well-defined clean edge (margin of bone defect)", and "a flat, smooth, polished cut surface" on macroscopic observation (Boylston, 2000).

Results and Discussion

Figure 2 shows the preserved condition of the cranium excavated at the Kasai castle site. The morphological features of this cranium indicate that of a female, and the age at death is inferred to be middle age, around 30 to 49 years old.

Fig. 2. Photographs of the cranium of the Kasai Castle site.

Sharp-force trauma is found in two areas, the left temporal bone and the occipital bone (the arrows in Figure 3). The maximum length of the trauma on the left temporal bone is 41 mm, and the maximum width perpendicular to the maximum length is 15 mm. The smooth surface of this trauma is directed downward and posteriorly, and it is curved rather than flat (Figure 4). The smooth surface of the occipital bone can be divided into the left and right facets with a ridge running horizontally on the central part of this smooth surface (the white arrows in Figure 5). The maximum length of the left facet is 37 mm, and the maximum width perpendicular to the maximum length is 14 mm. This facet is relatively flat, and multiple striae have been found (the black arrows in Figure 5). The maximum length of the right facet is 33 mm, and the maximum width perpendicular to the maximum length is 16 mm. The surface of this right facet is curved, with approximately the same curvature as the trauma on the left temporal bone. The smooth surface of the left facet interrupts that of the right facet. It may be inferred that the right facet was produced by the same blow that produced the smooth surface on the left temporal bone, and the later blow formed the smooth surface of the left facet. In other words, the assailant used a sharp tool with a blade of length at least 40 mm and delivered a blow to the base of the

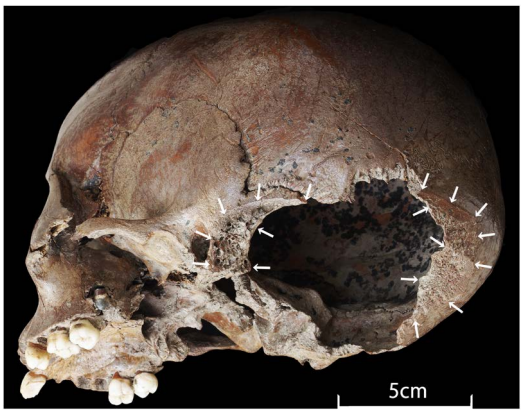

Fig. 3. Overview of the sharp-force traumas of the cranium obtained from the Kasai Castle site. Arrows in this figure indicate the margins of bone defects.

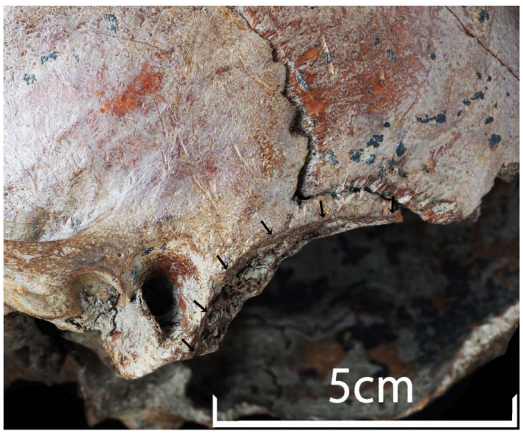

Fig. 4. Close view of the cuts on the left parietal bone of the cranium from the Kasai Castle site.

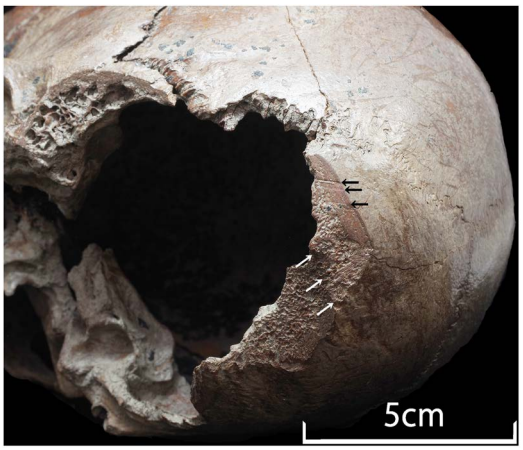

Fig. 5. Close view of the cut marks on the occipital bone of the cranium from the Kasai Castle site. Black arrows indicate the striae on the surface of the left smooth cut surface, and white arrows indicate the ridge line distinguishing the left and right smooth cut surfaces.

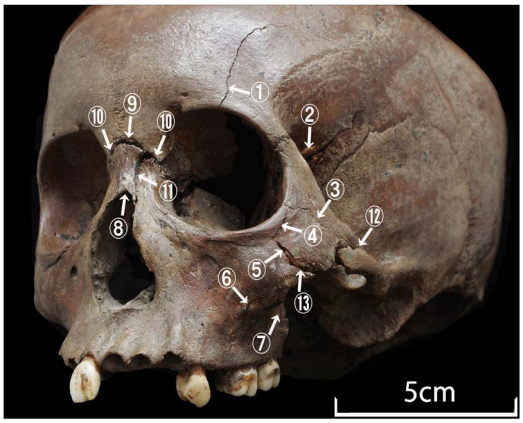

Fig. 6. Fracture lines and separations of sutures in the left facial part of the cranium from the Kasai Castle site.

head from behind, or behind and to the left of, the victim's head. The tip of the blade curved downward as it moved, simultaneously fracturing the left temporal bone and the occipital bone of the victim. The assailant then delivered another blow running from right-superior to left-inferior direction at approximately the same location. It is highly probable that these blows are a sign of decapitation. Decapitations in Japan during historical times were cuts through the cervical vertebrae, and sometimes the traumas on the occipital bone could be occurred as a mistake of cutting during a decapitation (Morimoto and Hirata, 1992; Sakaue, 2010).

Blunt-force trauma was also found in the left facial region of this cranium. As shown in Figure 6, multiple fracture lines are found, and they are in the following places: frontal bone (① in Figure 6), sphenoid bone (②), left zygomatic bone (③, ④, ⑤), left maxillary bone (⑥, ⑦), and left nasal bone (⑧). Multiple separations of sutures are also found, and they are in the following

Fig. 7. Photographs of the cranium from the Oda Castle site.

places: left and right frontonasal sutures (⑨ in Figure 6), left and right frontomaxillary sutures (⑩), left nasomaxillary suture (⑪), left temporomaxillary suture (⑫), and left zygomaticomaxillary suture (⑬). These fracture lines and suture separations may be blunt-force traumas caused by some blunt tool hitting the area of the left zygomatic bone (Kimmerle and Baraybar, 2008). This suggests that the victim may have been assaulted before receiving the blows to the base of the head.

Accordingly, there is a high probability that this cranium belongs to a victim who died in battle or was executed. However, since the mandible is missing, there remains the question of why only the head was discarded into the moat immediately after the decapitation. It seems that the blows that made sharp-force traumas did not damage and remove her mandible because their trajectories might be curved downward and run beneath her mandible. Therefore, it is possible that the mandible was still joined to the cranium by soft tissue immediately after her cervical region was cut. There was almost no water flowing in the discovered moat, and the head was covered with mud of high viscosity; hence, it is hard to imagine that, after decapitation, the head with the mandible and other parts attached was placed in the location where it was excavated and thereafter only the mandible moved elsewhere.

Fig. 8. Right lateral view of the cranium from the Oda Castle site.
Arrows in this figure indicate the margin of the bone defect. Double arrows indicate the notch of this cut mark.

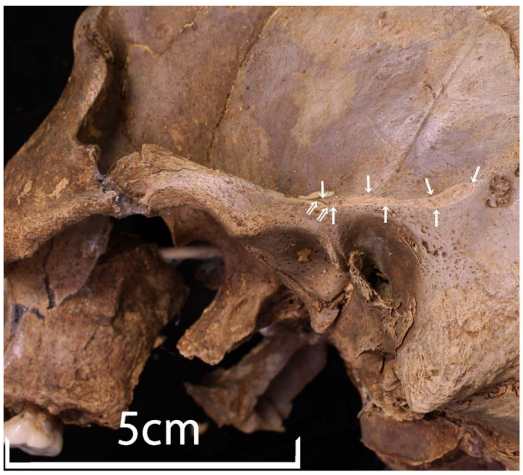

Fig. 9. Left lateral view of the cranium from the Oda Castle site.
Arrows in this figure indicate the margin of the bone defect. Double arrows indicate the notch of this cut mark.

Thus, it may be inferred that the head was placed where it was excavated after it was decapitated and had lost other parts such as the mandible.

Figure 7 shows the preserved condition of the cranium excavated at the Oda castle site. The estimated sex of this cranium is of a female, and the age at death is inferred to be middle age, from 30 to 49 years old. One large sharp-force trauma in the right parietal bone and right temporal bone, and one small, narrow trauma in the left temporal bone are found (Figures 8 and 9). The maximum length of the trauma in the right parietal bone and right temporal bone is 77 mm, and the maximum width perpendicular to the maximum length is 17 mm. The smooth surface of this trauma faces right and posteriorly, and is flat. At the most posterior end of this trauma, there are notches (the double arrows in Figure 8) where a sharp blade entered and stopped. The posterior portion of the smooth surface is wider than the anterior portion. Therefore, it may be inferred that the assailant used a sharp tool with a blade of length at least 70 mm and delivered a blow in the direction perpendicular to the right side of the victim's head from behind. Further, the maximum length of the trauma on the left side of the head is 26 mm, and the maximum width perpendicular to that is 3 mm. At the most anterior end of this trauma there are extremely small notches (the double arrows in Figure 9). It may be inferred that this small, narrow trauma was made by using a sharp blade to slice the surface of the bone thinly. Since this trauma is located directly above the external auditory foramen, it may be inferred that it was made to amputate the victim's ear. Ear amputation was performed as a punishment or as a substitute for decapitation from medieval times to the Edo period (Shimizu, 2015). According to Shimizu (2015), there are written records that ear amputation was often performed on criminals of women, and it is assumed that this punishment was used to avoid executing a woman. This cranium is also that of a woman, although she too suffered a deadly blow to the head.

Accordingly, there is a high probability that this cranium belonged to a victim who died in battle or was executed. However, in this case as well, the mandible and cervical vertebrae are missing. Once again, there was almost no water flowing in the discovered moat and the head was covered with mud of high viscosity. Therefore, in this case too, it may be inferred that for some reason the cranium was placed where it was

Fig. 10. Photographs of the cranium from the Okayama Castle site.

excavated after it had become separated from the mandible and the cervical vertebrae.

Figure 10 shows the preserved condition of the cranium excavated at the Okayama castle site. The shape of the cranium reveals that of a male, and the age at death is inferred to be middle age, from 40 to 59 years old. One large sharp-force trauma is found in the frontal bone and the left parietal bone (Figures 11 and 12). The maximum length of this trauma is 148 mm, and the maximum width perpendicular to the maximum length is 3 mm. The direction of the smooth surface of this trauma is discontinuous, facing the left from the most anterior edge to the frontal eminence on the frontal bone, then facing left and right from the frontal eminence to the area posterior to the left parietal bone coronal suture, and then facing left for about 15 mm toward the area anterior to the parietal bone lambdoid suture. At the most posterior end of this trauma, there is a notch (the double arrows in Figures 11 and 13) where a sharp blade entered and stopped. The smooth surface is wider in the posterior portion than in the anterior portion. From these characteristics, it may be inferred that the assailant used a sharp tool with a blade of length at least 145 mm and delivered a blow from a position behind the victim's head in a direction perpendicular to the right parietal region of the victim. From this trauma, the fracture line runs through

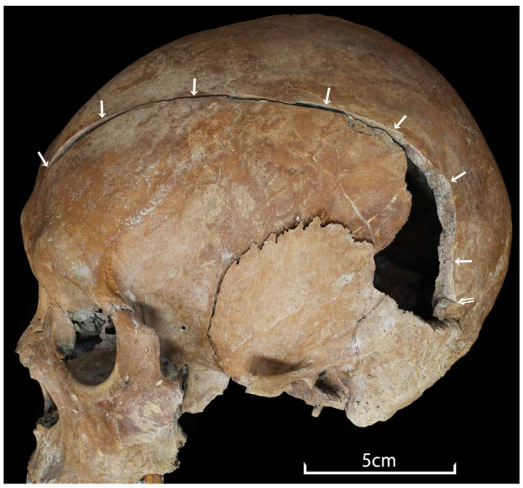

Fig. 11. Left lateral view of the cranium from the Okayama Castle site.
Arrows in this figure indicate the margin of the bone defect. Double arrows indicate the notch of this cut mark.

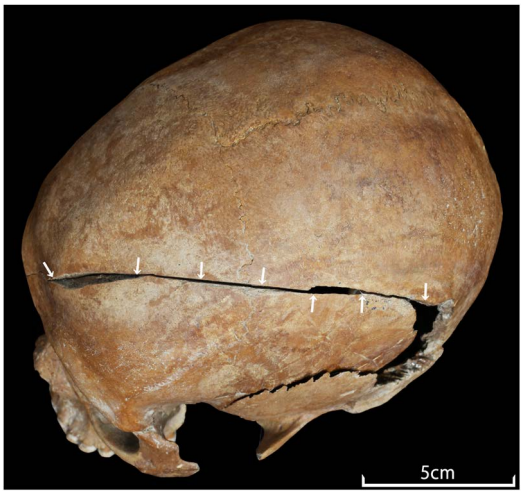

Fig. 12. Superior view of the cranium from the Okayama Castle site.
Arrows in this figure indicate the well-defined clean edges of the bone defect.

Fig. 13. Lateral-posterior view of the cranium from the Okayama Castle site.
Double arrows indicate the notch of this cut mark.

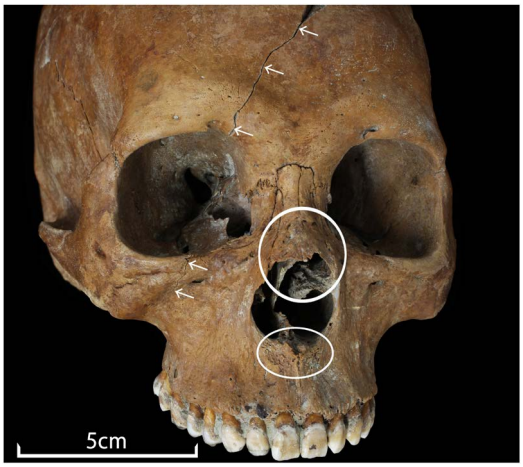

Fig. 14. Facial view of the cranium from the Okayama Castle site.
Arrows indicate the fracture line accompanying the cut mark. The upper circle shows the healed compression fracture, and the lower circle shows the bone changes around the inferior margin of the pyriform aperture.

the right orbit to the right maxillary bone (Figure 14).

The tip portions of the left and right nasal bones of this cranium show the healed fracture in a collapsed condition (the upper circle in Figure 14). Therefore, it can be determined that this is a healed compression fracture of the left and right nasal bones. Further, around the inferior margin of the pyriform aperture, there is minor ossification and partial collapse, and the anterior nasal spine is deformed (the lower circle in Figure 14). These are also considered to be healed fractures.

Accordingly, there is a high probability that

Fig. 15. Preservation stage of crania from the Edosaki Castle site.
The left cranium of this figure was named of 'O 01' and the right one was 'O 02' in the report of Baba *et al.* (1987). They show the best preserved bones among the skull fragments excavated from the Edosaki Castle site. These specimens are now in the custody of the National Museum of Nature and Science, Tokyo.

Fig. 16. Graphical expression of the hanging decapitated head with their hair
This picture was a part of "the picture scroll of the Gosannen War", which was the 14th-century painting about the Gosannen War (Later Three-Year War in 1083–1089 A.D.).

this cranium belonged to a victim with battle experience, and who also died in battle. However, in this case too, the mandible and cervical vertebrae are missing. Once again, at this site no water was flowing in the discovered ditch, and the head was covered with mud of high viscosity. Therefore, for this cranium as well, it may be inferred that for some reason the cranium was placed where it was excavated after it had become separated from the cervical vertebrae.

The three crania excavated from the three castle sites presented in this paper show the following common characteristics: 1) The cranium was discovered in an undisturbed environment of a moat or ditch. 2) The preserved condition was extremely good, but only a cranium was found, while the cervical vertebrae and mandible were missing. 3) Trauma caused by use of sharp tools was revealed. 4) The blows that caused the trauma were inflicted from behind the victim's head. 5) It is highly probable that the person died in battle or was executed.

Other castle sites where human skeletal materials of battle victims were excavated are the Kojo-nishi site (Edosaki castle) (Baba *et al.*, 1987), the Osaka castle site (Nagaoka and Abe, 2007), and the Kunohe castle site (Dodo *et al.*, 2008). Of these, a cranium was not excavated from the Kunohe castle site. The human skeletal remains excavated from the Edosaki castle site are considered to be those of a victim when the castle was destroyed in 1560, and this was also discovered in the remains of moats similar to those of the three crania presented in this paper

(Baba *et al.*, 1987). Human skeletal remains of at least 24 individuals were excavated from this site with any parts of skeletons including cranium, mandible, postcranial long bones, etc. Twenty seven sharp-force traumas were discovered in 17 skulls or skull fragments. However, the human skeletal remains excavated from this site had remarkable breakage on their bone surface, and the cranium was not well preserved (Figure 15). Further, the human skeletal remains excavated from the Osaka castle site are considered to be those of victims of the winter siege of Osaka in 1614 and were discovered in the outer moat of Osaka Castle (Nagaoka and Abe, 2007). According to Nagaoka and Abe (2007), skeletal remains of at least 6 individuals were excavated, and five sharp-force traumas were found on one of the crania. The crania excavated at this site were found with mandibles and cervical vertebrae. Considering these cases, the fact that the crania from the three castle sites reported here lack mandibles or cervical vertebrae is certainly unique.

Here are the possible scenarios for a case in which just only the cranium of a battle victim is discovered in a moat or ditch: 1) The person was decapitated after the battle, and the head was left exposed. Thereafter, the joints separated as a result of decay, and only the cranium fell into a moat or ditch. Especially, the mandible and cervical vertebrae might have fallen away soon after decomposition of soft tissues in the condition of hanging the decapitated head with their hair (Figure 16). However, the crania of three castle sites presented here, as also seen in Figure 15 for the Edosaki castle site, show no sign of cracking, flaking, or bleaching from sun exposure, nor are there bite marks such as those of rodents and carnivores. It would also not be reasonable for just one person among the victims of the fall of a castle to be left exposed. 2) After a battle and/or decapitation, the skull was processed by removing the cervical vertebrae and mandible, and then left to sink into a moat or ditch. It is possible that this was some kind of ritual, for example, to conceal the head of a specific person or a form of human sacrifice after the completion of building a castle. However, in three crania presented here, there is nothing that could considered a mark from a dissection; nor do any documents mention any such rituals. Further, the fact that the head received a blow from behind would be inconsistent with a ritual act. Reports of new cases are desired for further inferences.

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