CHAPTER I

Forensic Evidence and the Human Skeleton

Too often, we hear that a human body reduced to pieces of bone is beyond telling us anything; that the identity of the victim or assailant can never be known. Occasionally this is true, but one man who thought so awaits extradition to Canada to face a charge of homicide. This derives from our recovery, five years after the fact, of a human body reduced through deliberate cremation and extreme fragmentation to less than 900 grams of bone and tooth fragments, with dental work, numbering in the many thousands.

Another case involved a prospector who disappeared from his cabin in a remote valley in the southern interior of British Columbia. Near his camp were found four objects suspected to be human remains. Examination indicated that two of these were the chewed collarbone and first rib of an adult human being, likely male. The other two items were fingernails. Adhering to the bones were two types of hair: one long, slightly wavy, and light brown; the other, suspected to be beard hair, red and kinked. Combining this information with the remoteness of the camp meant that a death certificate in the name of the missing person could be issued.

Recently, burned bones were found in a secluded corner of a known criminal's property. Police suspicions of foul play were quickly dispelled by having one of us flown to the scene where excavation revealed the bones to be from a bear. Considerable time and expense were saved by this means.

Other cases could be cited, demonstrating that in most instances a significant amount of information can be obtained from even the most seemingly inconsequential skeletal material.

Skeletal remains come to light through a variety of means. The resulting investigation attempts to answer such general questions as: 1) are the remains animal or human; 2) if human, are they archaeological, historic, or recent; 3) if recent, who was the individual and what were the manner and cause of death; and 4) what postmortem events, acting for how long, have resulted in the current state of the remains?

Most identification officers can answer the first question with little difficulty, providing the remains are distinctive enough -- for instance, a skull. Answers beyond this require the services of a specialist in the analysis of human skeletal remains.

In most cases of unidentified found skeletal remains, the bones will have been submitted to a pathologist for autopsy before they are passed on to a forensic anthropologist. A medicolegal autopsy is an examination of a body to determine cause of death. The pathologist will also try to identify the remains and determine everything else of forensic importance.

However, forensic anthropologists are sometimes more familiar with or able to derive information from 'just bones'. Experience has shown that rarely does a local physician or even pathologist possess the requisite familiarity with the variability of detailed bony anatomy, particularly if the remains show the usual postmortem deterioration. Ideally, there should be close cooperation between the two specialists. In our experience this is a rare occurrence. Some accepted autopsy procedures, such as sawing open the top of the skull or cutting out the jaws, are not necessary on skeletonized remains and are positively inimical to the methods of the forensic anthropologist. The investigating officer can play an important role here if he is aware of the procedures preferred by different specialists.

In our opinion the goals of the pathologist and forensic anthropologist are identical. Examination of the bones by a forensic anthropologist is a second chance. It is in effect a second autopsy.

Where human skeletal remains are recovered directly by a forensic anthropologist or an archaeologist with expertise in bones, the bones may remain with this individual for analysis. On occasion, particularly with fragmented bones or 'possibly animal'

bones, the remains will be submitted immediately to the forensic anthropologist. This places a great deal of responsibility on the forensic anthropologist, who should attempt to acquire some knowledge about the sorts of evidence encountered by forensic pathologists (see list of recommended readings).

A list of anthropologists, archaeologists and anatomists throughout Canada and the United States who have expressed their interest in helping the authorities to recover and analyse human skeletal remains is included as Appendix 1.

This manual is meant to be a useful guide to the recovery of human bones. Our wish is simply to make the investigating officer's task more effective. It has been our experience that such individuals are very good at observing and recovering the kinds of evidence they have been trained to see. However, they cannot be expected to recover that which they do not perceive; for example, an empty tooth socket lacking the soil discoloration of other empty sockets, indicating a tooth has recently fallen out and lies nearby; empty fly pupae, little bigger than grains of dirt, signalling a significant lapse of time between death and burial; dental fillings released from a tooth crown exploded in the heat of a fire. In other words, a poor return of information for one's efforts is not usually due to errors of commission, but to natural omission through lack of awareness of: a) the appearance of the human skeleton; and b) how its innate variability, and that deriving from postmortem decomposition, can tell us so much.

The manual is divided into four basic sections. The first deals with archaeological techniques, suitably modified for forensic cases, for the recovery of surface and buried human skeletal material (Chapter II). The second part explains how such basic information as age and sex, plus uniquely individual traits, are derived from bones and teeth (Chapter III). Our intent is to ensure that the investigating officer understands the strengths and weaknesses of both the evidence he is collecting and the conclusions drawn by the specialist. The next section deals with the contribution that the forensic anthropologist can make to interpreting the manner and cause of death (Chapter IV). The difficult topic of determining elapsed time since death is discussed in Chapter V, with an emphasis on how plants and insects associated with the remains can help with this problem. The final major section explores the expanding role that anthropologists and archaeologists can play as forensic investigators, particularly in the analysis of animal bones, and human cremations. Anatomical reconstruction of bone fragmented by firearms trauma and modelling a face onto the skull are techniques that are relatively new in their

application to forensic cases in Canada. These topics are discussed in Chapter VI.

We have tried to avoid complex terms. Words which are likely to be unfamiliar to the non-specialist are expressed in bold face where they first appear in the text and are defined in the Glossary.

All investigating officers will appreciate the nature of an autopsy and the wealth of often startling data to be had from a pathologist's careful analyses. Human skeletal remains, perhaps with dried soft tissue remnants and often visibly altered by events at or subsequent to death, are in their own way no less important or informative and should be handled with the same rigour, reverence, and motives.

Evidence has been defined as "information, whether in the form of personal testimony, the language of documents, or the production of material objects, that is given in a legal investigation to establish the fact or point in question" (Oxford English Dictionary). The human **SKELETON** constitutes physical evidence. It can be used to establish new facts or to corroborate the testimony of witnesses.

Many of the bones brought to the attention of the police are non-human. Most of the remainder represent the remains of often identifiable missing persons who have died by misadventure or suicide. A small but significant portion, the victims of homicide, were never meant to be found. The fact that an unidentified person has died, regardless of the manner of death, is of interest to the courts of law; that is, the bones are of **FORENSIC** significance. Our society demands that the death of every individual be noted. Surviving relatives, beneficiaries of insurance policies and wills, business partners of the deceased -- all have a legitimate interest in knowing of a particular someone's death.

These remains may have suffered variable degrees of destruction as a result of natural agents, such as animals or climate, or through deliberate acts of violence contributing to death, or in attempts to cover up the death subsequently. Bones and teeth are, however, highly resistant biological materials and the individual characteristics of these **HARD TISSUES** plus the consequences of **PREMORTEM** and **POSTMORTEM** physical trauma affecting them, may preserve remarkably well. Usually sufficient detail will preserve to permit the **FORENSIC ANTHROPOLOGIST** to determine at a minimum the age at death, sex, race and stature of the individual concerned with a known degree of confidence. Furthermore, individual identification is possible when diagnostic portions are preserved for comparison with premortem records.

Apart from cases of violent death producing, for example, such evidence as bone **CRATERING** in gunshot wounds, rarely can one discern specific features of the bone directly related to death. Investigation can show however which features are definitely not associated with the person's death; such as premortem fractures, postmortem **DISMEMBERMENT**, **CREMATION**, or animal activity (Fig. 1). The appearance of traumatized skeletal remains can suggest the **INSTRUMENT** or class of instrument responsible for the effects observed (Fig. 2). A direct physical match between an alleged instrument and **TOOL MARKS** imparted to the bone may be possible (Fig. 3). Such marks may indicate the manner and direction of assault.

It cannot be overemphasized that thorough analysis and correct interpretation of the evidence obtained from the human skeleton require as complete a recovery as possible of the remains and associated materials (for example, projectiles and personal effects). This includes accurate notation of the precise relationships both among the various recovered skeletal elements and associated items and between these and their physical and climatic contexts, as this information can be especially significant.

In summary, it is possible from the skeletal material, associated items, and the context of each to identify the individual and to reconstruct some of the events occurring at, around and after death; all of which can constitute evidence in subsequent legal proceedings.

a

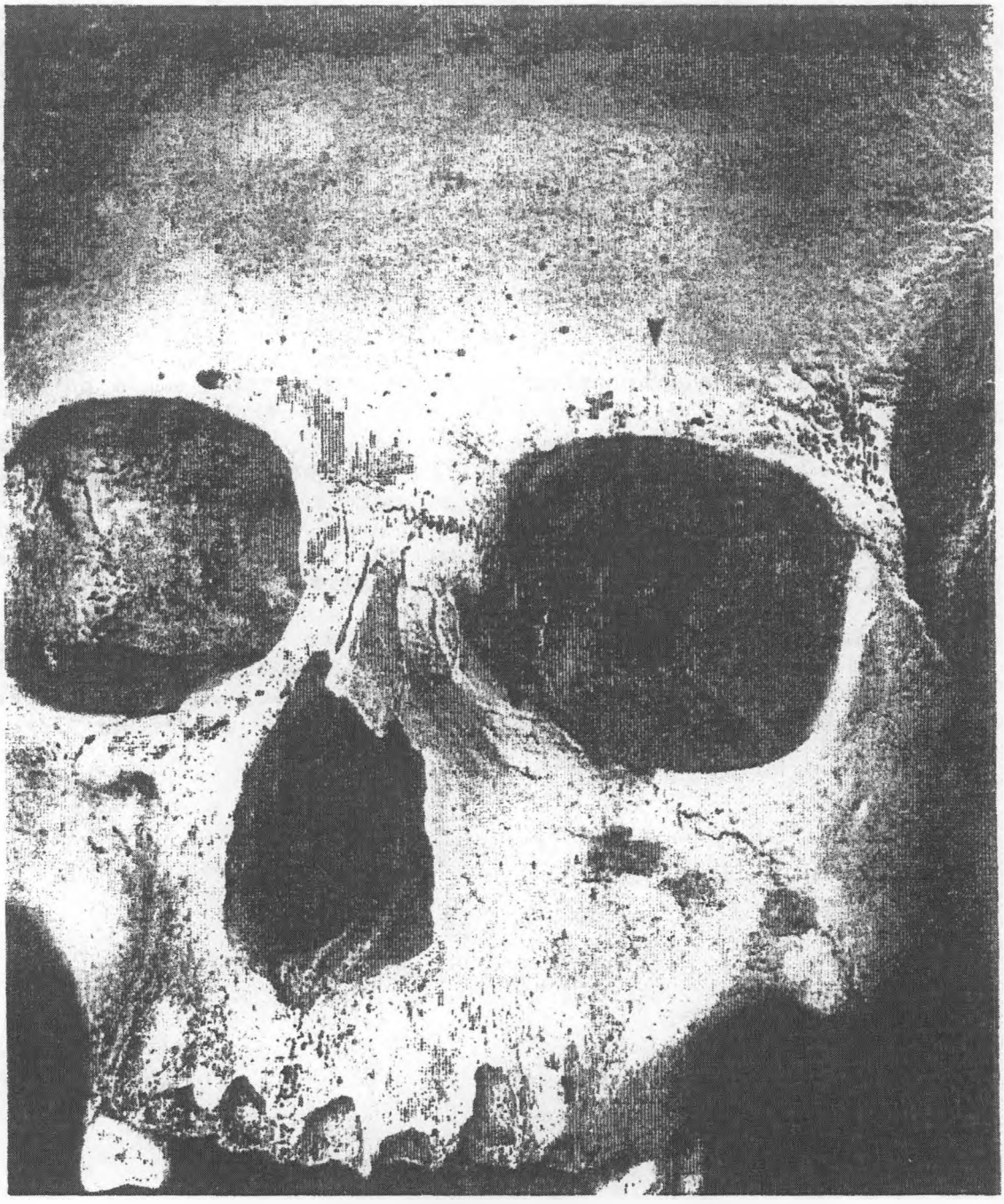
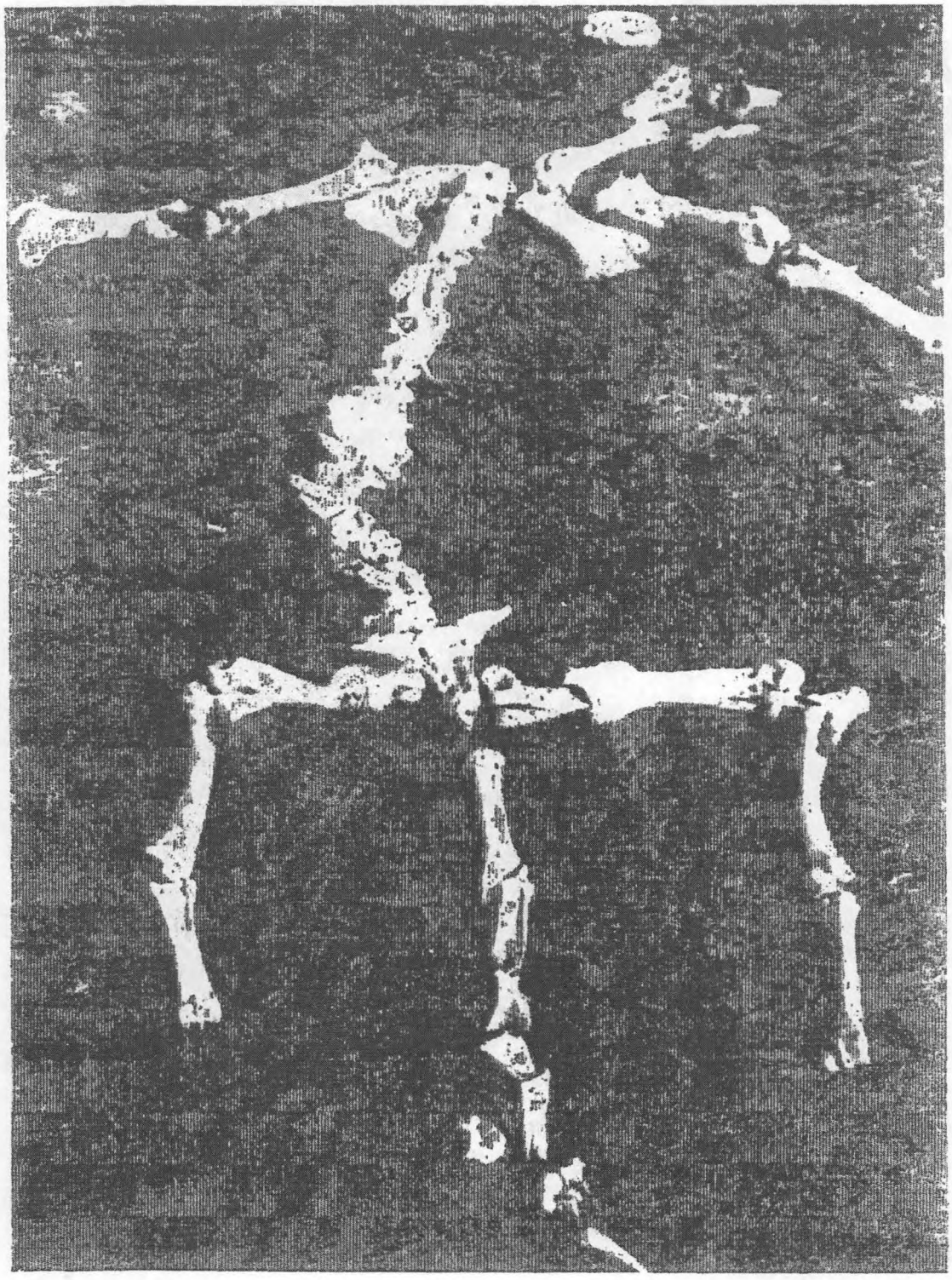


Figure 1. Postmortem appearance of bone: a) Effect of animal activity on human bone: striations above the left eye produced by rodent incisors (Case 77-3). b) Effect of human activity on animal bone (courtesy of J. McIvor).

b



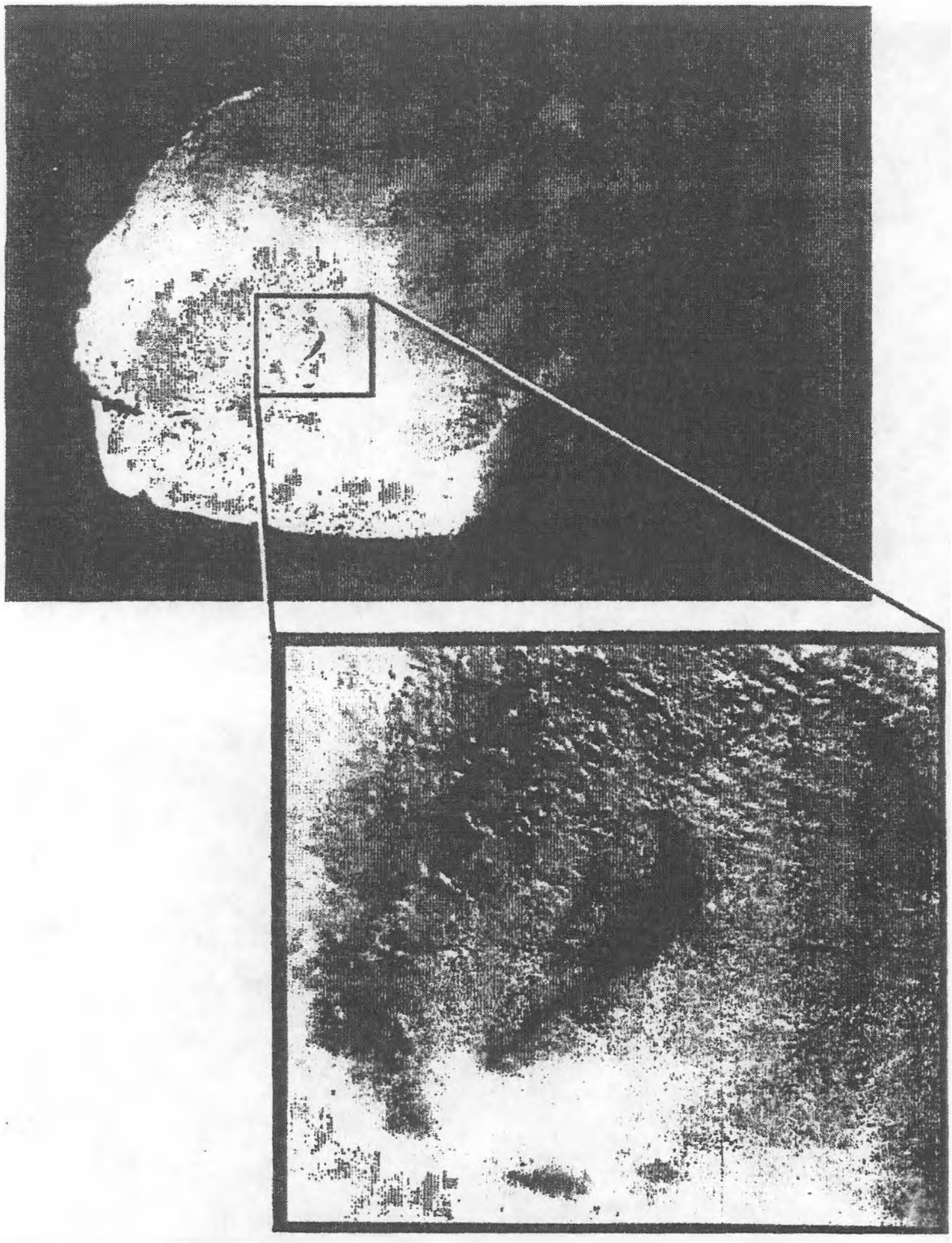


Figure 2. Class of instrument producing tool mark on bone. Typical wedge-shaped penetrating wound on right parietal (see inset) produced by single-edged knife point (Case 80-16).

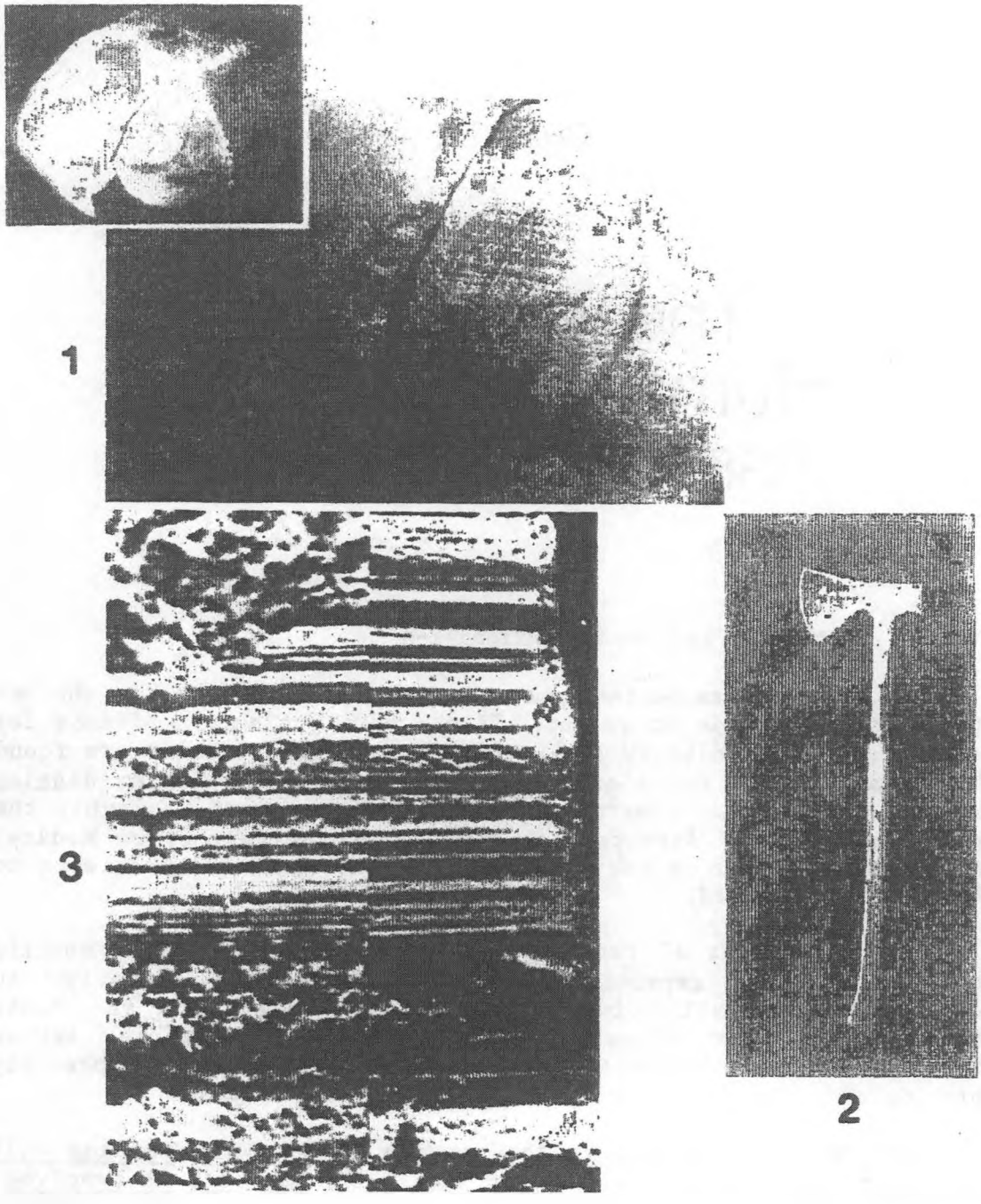


Figure 3. Specific instrument producing tool mark on bone. 1) Left frontal showing shallow, scooped-out appearance with striations produced by a glancing blow from a hatchet (inset shows top of skull). 2) The hatchet. 3) Stereocomparison view of scratches on bone (left) matched to those in test cut from hatchet in wax block (Case 80-16).