



Rocks and Residues: Rekindling the Past

Microscopy of Flint Flakes

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Abstract

Exactly when and where humans gained control over fire has been an archaeological dispute for years. What is undisputed is how profound of an impact this discovery had on human evolution, influencing everything about how people lived. It provided protection and warmth, allowed for cooking, and likely changed social structures as a whole. Determining when this milestone was reached, and thus how exactly it impacted our past, requires a way to discern if fires were started incidentally, or opportunistically controlled. This can be done by examining the tools that would have been used to make the fires: strike-a-lights, or pieces of flint which have been hit against a sulfuric iron core to produce sparks. We created a series of strike-a-lights and examined them microscopically for use-wear and residue traces. Findings showed a distinctive trace remained from use as a strike-a-light as compared to contact with other minerals.

Introduction

Learning how to control fire changed much about the ways we lived. Rather than scavenging for burning embers leftover from wildfires and lightning strikes, at some point, hominins learned to create it themselves.. Controlled use of fire would have been necessary for Neanderthal populations moving into Paleolithic Northern Europe. It also would have allowed for cooking, which has been linked to the origins of genus *Homo* (Wrangham, 2009).

In order to determine the connection between controlled fire and these events in human evolution, when fire was harnessed needs to be determined. As of yet, there exists no method by which to determine whether archaeologically found incidences of fire were controlled or opportunistic other than to find the tools which led to the creation of fire.

There are two methods by which survivalists and remote groups predominantly make fires: wood-on-wood and stone-on-stone. Since wood-on-wood firemaking tools decompose over time, stone-on-stone is the best method to study. Its simplicity also makes it a better candidate for the earliest used method. Northern populations (where the use of fire is imperative) also more commonly use stone-on-stone (Sorensen et al., 2014).

This method involves striking a piece of flint (usually a flake) against a core of sulfuric iron. In the fossil record, only the flint readily survives. Traces of sulfuric iron powder have also been found from the Upper Paleolithic onward, but few large cores are recovered (Sorensen et al., 2014).

One way of examining this production is the expedient strike-a-light model. This model, proposed by Sorensen et al. assumes that, since flint flakes are easy to make, they'd be discarded after the making of every fire, and that the rear platform (not examined in traditional microscopy of artifacts) would be the worked edge. This study was designed to confirm earlier tests on the model by examining wear and residues on lightly used strike-a-lights.

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Fig. 1

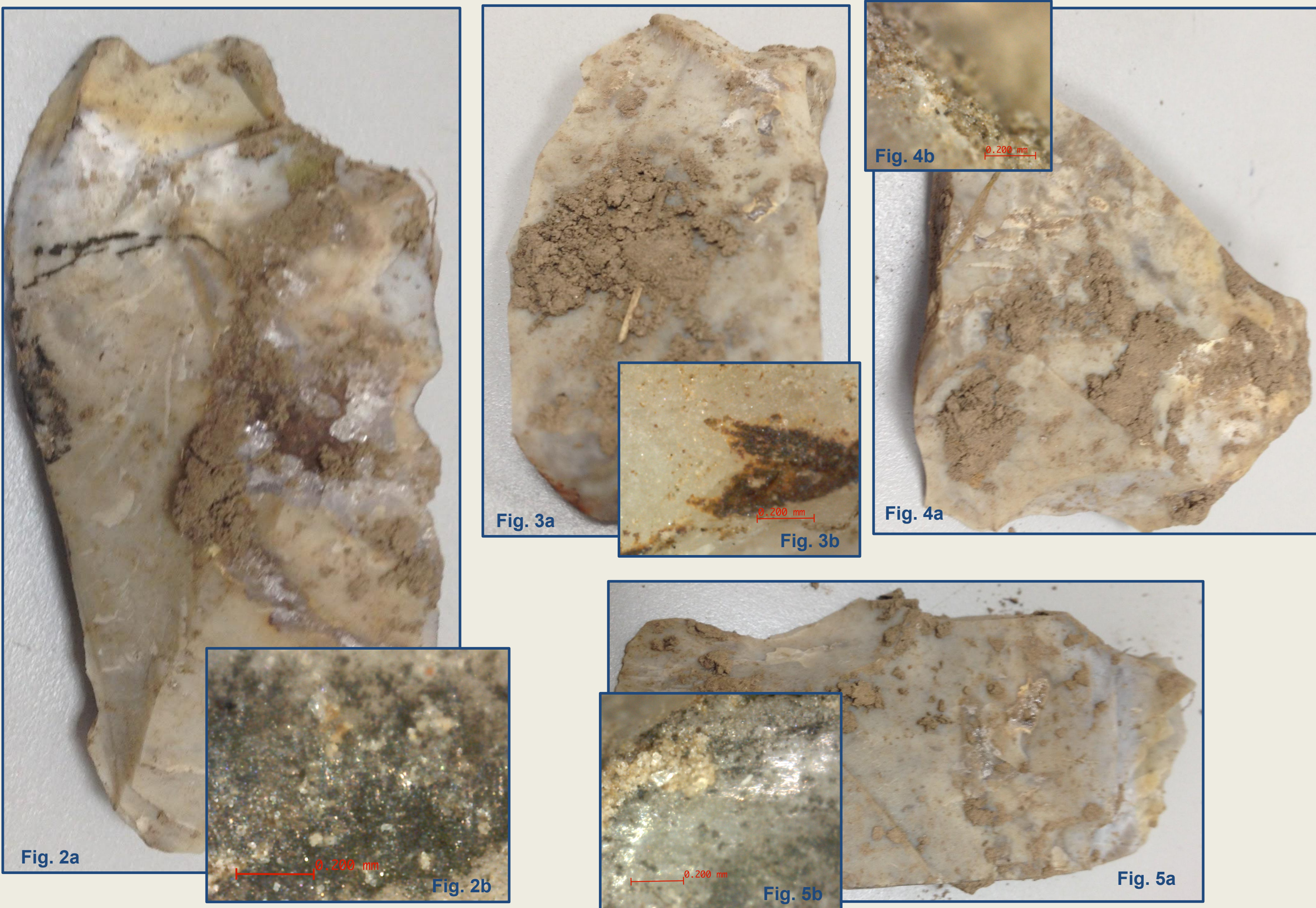


Fig. 1: All samples used in blind test after retrieval. Samples shown in detail have been circled and labeled. Figs. 2-5: Macroscopic (a) and microscopic (b) views of double blind samples 2, 9, 12, and 24, showing wear and residues from various contact minerals. Fig. 2: Sample DB2, showing wear from a generic low-content source of sulfuric iron. Fig. 3: Sample DB12, and detail of wear from contact with a highly oxidized iron mineral. Fig. 4: Sample DB24 showing no chipping or residue on dirt-covered surface. Fig. 5: Sample DB9, with residue corresponding to contact against marcasite, or a high sulfuric-iron content mineral.

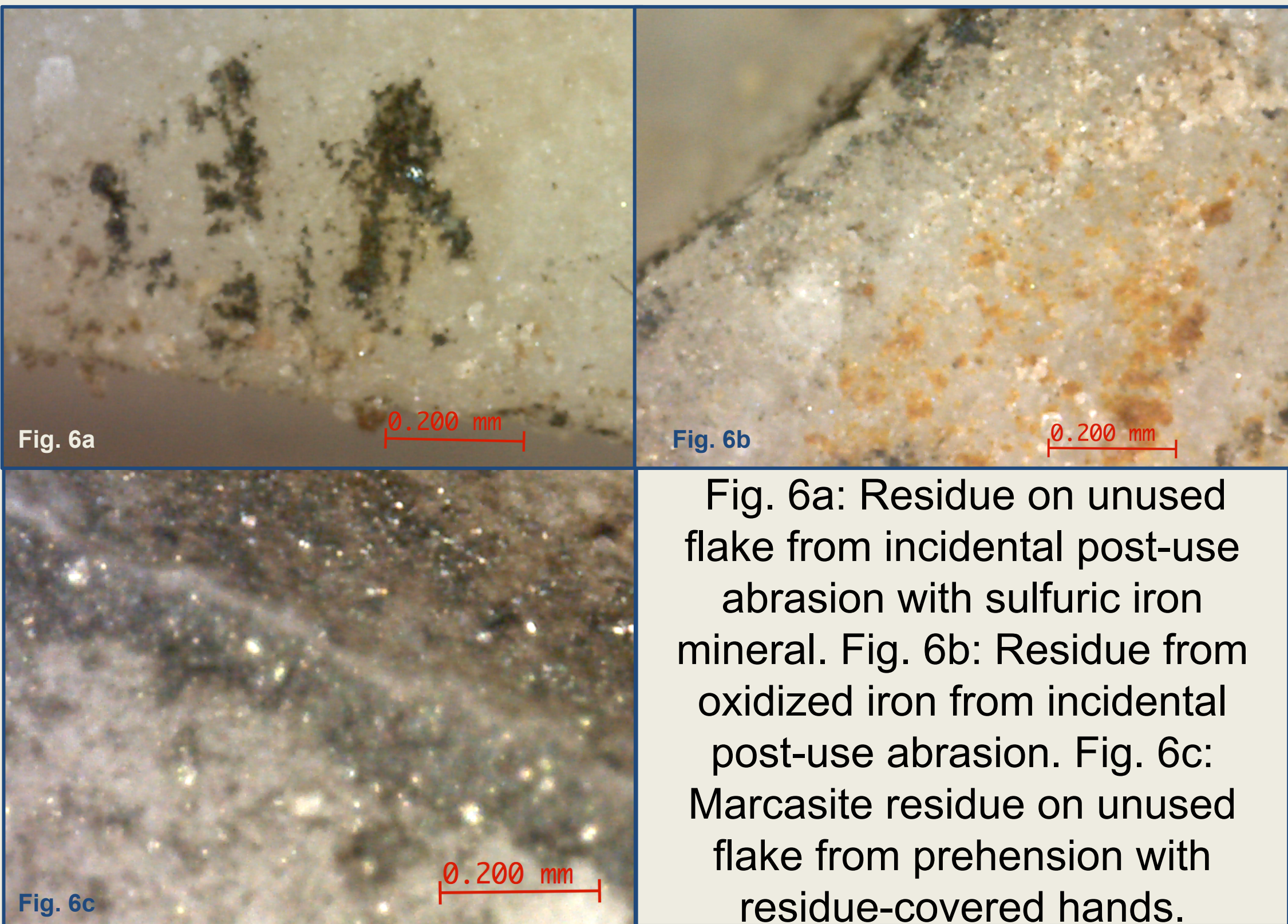


Fig. 6a: Residue on unused flake from incidental post-use abrasion with sulfuric iron mineral. Fig. 6b: Residue from oxidized iron from incidental post-use abrasion. Fig. 6c: Marcasite residue on unused flake from prehension with residue-covered hands.

Methods

Many flakes were obtained and struck against marcasite cores, and examined at varying magnifications under a Dino-Lite AD-4013MZT digital microscope.

Unused samples were later given to a third party for use in a blind test of the wear patterns. In the test, 25 flakes were struck against either a marcasite core, a rock with inclusions of sulfuric iron, a heavily oxidized piece of iron, or unused.

Rocks were then buried for two weeks during heavy rain for weathering before being examined microscopically as with the earlier tests.



Results

During the course of the project, we succeeded in creating fire with both stone-on-stone methods and wood-on-wood.

Selected samples of the blind test are shown and described to the left (Figs. 1-5). Blind test results showed 96% of samples correctly identified as used or unused, with the specific mineral described with 76% success.



Discussion

Flakes used during the blind test were all held in the same container, and abraded slightly during moving of the pieces, leaving "red herring" residues, most of which were identified as such (Fig. 6).

Overall, however, the blind test validated the findings of Sorensen et al., confirming that the traces left by sulfuric iron on flint flakes is distinctive and recognizable in a simulated setting. In an archaeological setting, these residues can be weathered and obscured by time, and could also bear resemblance to marks left on the flint during excavation. The findings of this project can be applied towards the archaeological record to look for traces of fire as per the expedient strike-a-light model.

During early experimentation with fire production, however, greater incidence of spark production and success in firemaking was noted when using the marcasite piece as a hammerstone (mimicking flintknapping) against a larger core of flint. This process of a "hammer-stone of pyrites... [likely] gave rise to the discovery of that method of producing fire" (Evans, 1897, p.313). This method could be examined more thoroughly as a future study.

References

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