

TSIRK, A. 2014. *FRACTURES IN KNAPPING*. ARCHAEOPRESS, OXFORD.

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(PB/EP, xii + 261 PP., 138 FIGURES, 27 TABLES. B/W ILLUS. PB £25, EP £19.99)

This book outlines the basics of fractography and fracture mechanics from the premise that these are essential to lithic research. That is, understanding the formation, meaning and analytical potential of fracture markings (Tsirk 2014, ix & 1) — known to lithicists as attributes (*sensu* Odell 2003, 87; Hranicky 2013, 101) — is fundamental to a complete comprehension of lithic *chaîne opératoire*. Consequently, Tsirk distilled his teaching notes (Tsirk 1997) augmented with his published work into a summary (Adams 2015, 135–136). However, a few issues make it less presentable.

One issue is its structure. There are 14 chapters grouped into three parts: Part one (chapters 1–3) provides a survey of knapping; Part two (chapters 4–8) introduces the fundamentals of fractography; and Part three (chapters 9–13) explores how fractography relates to knapping. Chapter 14 concludes the book. This structure is confusing, as it would appear that he wrote these parts as if they were the chapters themselves. The appearance of parts as chapters may explain why Tsirk wrote Part one as the introductory chapter, Part two as one explaining what the markings are and Part three as why they are important. Also, with few exceptions (e.g. Tsirk 2014, 232), there is a paucity of signposts, introductions (e.g. outlining aims and objectives) and conclusions to lead the reader. Consequently, the absence of standard structure obscures and disjoins Tsirk's arguments by spanning them across the book rather than together in single chapters.

Similarly, there are three content weaknesses. First, the book is limited as it is from solely an American knappers' and fractographers' perspective. For instance, he misses the opportunity to show how fractography and fracture mechanics elucidate both *chaîne opératoire* (*sensu* Inizan *et al.* 1999, 14; see also Leroi-Gourhan 1943) and reduction trajectories (Odell 2003, 87). Secondly, given that raw material variability plays a significant role in affecting knapability, the survey of types in Chapter 3 is too small and non-geological. Furthermore, more could have been made of his discussions on mechanical properties. For

example, he misses the opportunity of a detailed discussion of flaws and inclusions that can interfere with Hertzian force waves, thereby affecting the predictability of fractures of the raw material. Thirdly, Tsirk over-relies on jargon, and while he defines terms clearly and concisely in some figure captions and the glossary, he inadequately introduces them fully in the text. Rather than listing the terms in tables (i.e. Tsirk's tables 4.1–4.5) and providing their definitions separately in the glossary: he should have subsumed these together as well as fully defining the concepts in the main text. Thus, the issue is not one of content, but rather of structure. For instance, a single chapter containing what a feature looks like (definition), how it forms (mechanism), what it indicates and how one measures it, would have been more desirable.

Likewise, while Tsirk (2014, 232) claims to rely on an empirical rather than a theoretical understanding of fracture, the book is largely theoretical. This data-theory polemic is interesting for five reasons. First, this polemic misunderstands the scientific method that necessarily uses theoretical lenses (*sensu* controlling models, Clarke 1972) to interpret data after acquisition. Secondly, although Tsirk re-examined thousands of fracture samples (Adams 2015, 136), he provides little data to elucidate the concepts involved other than the micrographs of attributes and a few occasional tables. Thirdly, other than a few brief sentences (Tsirk 2014, 56), he does not share the method he used. Fourthly, the data descriptions are intermixed with interpretation. Fifthly, a work through of the formulae with data would have been more useful in explanations. These issues leave the reader unable to replicate and hence ascertain the veracity of his conclusions. Therefore, the book would have benefited from precise methods, more data and their separation from interpretations.

Notwithstanding data issues, the figures and tables (especially their captions) greatly elucidate and enhance the explanations. Also, the micrographs, a highlight of the book, are very instructive and well annotated. However,

in text references to them are too infrequent, and their placement is often well after the associated text. Moreover, some diagrams are put together from other sources with a mixture of crude pen and computer annotations (e.g. figures 3.2, 6.1 & 6.2), hand drawn with previous pencil markings, inked lines that have bled (figure 6.2) or poorly reproduced from graph paper (figure 6.1). The use of graphics software would have eliminated these issues. Therefore, the quality of some of the diagrams significantly detracts from the book.

Likewise, it is also problematic that the intended audience is too diverse, each with different needs. For instance, Tsirk (2014, ix & 232) aimed to stimulate knapper's interests with an introductory text in the interpretation of fractography and fracture mechanics, draw the attention of fractographers' to knapping, and facilitate communication between them. This identity crisis is compounded further by the fact that he aims each part of the book at different audiences underlines this conflict. For example, he aims Part one at fractographers with a very cursory introduction to knapping. Part two is for knappers — to clarify and explain the mechanisms involved in knapping — but also for fractographers to acquaint them with the fractures involved with lithic artefacts (Tsirk 2014, 232). Tsirk aims Part three at both fractographers and knappers with the objective of outlining knapping fractures and clarifying fracture mechanisms. However, the overall, emphasis is primarily a fractography one (and rather than knapping with an almost complete neglect of an archaeological/cultural perspective).

Consequently, Tsirk ignores lithicists. On the one hand, this is because he assumes that knappers and lithic analysts are the same. While many lithicists knap, not all knappers are lithicists. On the other, although Parts two and three are useful for lithicists, Tsirk does not outline how he envisaged the integration of fractography into lithics analysis and theory. This omission is a significant weakness compared to other books that discuss how to integrate both (e.g. see Andrefsky 1998, 23–37; Odell 2003, 45–80).

Furthermore, contrary to Tsirk's (2014, ix) claim, this book is not an introductory text for students (novices), just like Andrefsky's (2005)

Lithics: Macroscopic Approaches to Analysis is beyond an elementary level. A case in point is there are no illustrations of basic objective or detached piece anatomy (as can be seen in Whittaker 1994, figures 2.2 & 2.3, 15–16; Inizan *et al.* 1999, figure 5, 33; Waddington 2004, figure 22, 14). Therefore, Tsirk assumes the reader already knows this basic information. Consequently, this book appears to be more suitable for seasoned researchers. Therefore, it is evident that the author subconsciously wished to write an advanced textbook/manual for experienced researchers.

Therefore, in attempting to cater to diverse audiences, the book is an unhappy compromise. Consequently, Tsirk ultimately fails to deliver the required detail as they all have diverse knowledge bases, each needing different levels of information and supporting evidence.

Notwithstanding the issues noted above, this is Tsirk's most comprehensive work, and it demonstrates he had an extensive knowledge of the subject. While, this book requires effort from the reader, it provides a deeper insight and understanding that informs on the mechanisms involved, the signs of fractures and their interpretation. Thus, despite his ignoring the constituency of lithicists (noted above), the book is useful to them for two main reasons. First, although, a greater emphasis on the integration of fractography into lithics analysis and theory would have been beneficial, no one has hitherto solely dedicated a book to marrying an understanding of fractography, fracture mechanics and knapping. Secondly, the detail of the explanations, the diagrams, and micrographs make this a useful manual for experienced researchers. Therefore, this book is an essential read for advanced researchers and represents a significant contribution to the field.

Finally, the book is timely for two reasons. First, archaeologists have tended to afford a precedence to bio-archaeological and environmental evidence (Evans *et al.* 2007, 2161). Secondly, there has been a failure by many to appreciate basic technological principles, and a concomitant assumption that 'classification' through 'shape matching' artefacts with holotype illustrations is sufficient along with unjustified interpretations of form equals function. In contrast, this book shows that lithics research is a specialist domain

requiring a high level of knowledge that extends beyond typological counts. Moreover, it shows that understanding fracture mechanics with the ability to analyse in a replicable way the fractographic attributes underpin lithics research as a science. Thus, this implies that one cannot simply become a lithicist overnight but, like Tsirk, it takes a long apprenticeship and years of training to achieve (for discussion see Hranicky 2013, 45). The fact that Tsirk took 40 years to write this book is a testament to the complexity of lithic analysis, fractography and fracture.

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