Review: Parquer, de Kemp, Brodaric, Hillier
Consistency Checking 3D Geological Models

p2 l3 ~~lead to geologically questionable spatial interpolations~~
etc.

l6 I'd argue the same could be said for human-led compilation efforts where a) # of relationships is large
b) # of contacts that imply/require a geological order is large
Consistency is still consistency if you just have 1 human making a map.

this leads to line 2 on p4: with a truly complex situation (# rels, # polys) is manual inspection likely?

p4 l4 implicit knowledge can vary... yes, I agree, but to introduce that here... are you are no step in the model population process didn't also? And perhaps component data did too?

↳ line 7... and designed to limit/remove implicit?

l16 (not true but also not published → just an aside → using ArcView/Avenue the Harrap 2001 method was applied to checking GOO maps (with introduced errors)... and of course never published it.

l17 range of knowledge. Unclear
range of knowledge (for example, ...) perhaps.

l25 I would argue now (having read Burns after 2001) that his vision of using it as a tool to formalize knowledge in large areas → consistency while building → is very important. He just never thought to call it a legend language, but note his "chain diagrams" are well on their way to my ideas on graph rewriting.

p5. An aside, but fyi, the procedural generation community (video game world) is beginning to look at geological history / 3d volumes / etc. vis a vis applying terrain erosion algorithms (Guillaume Cordonnier ...) and though their goals are different, in the long run this is another form of consistency work.

> eg Gailleton et al 2024 Chonk 1.0 : landscape evolution framework : cellular automata meets graph theory Geosci Mod Dev 17, 71-90.

In your intro you almost nail down what a consistency-checking framework could be. I'd argue (and perhaps you disagree... which is fine) it has at least 3 uses

1) as a testing framework (the Davies case)
2) as a generative framework: can you generate alternative geological histories that are consistent with the data, or conversely, given a history in the singular sense can you generate permissable (testable) map relations (in Burns these would be testable binary relations, in Harrap these would be adjacency relations that are consistently permissable in a GIS).
3) As an artifact that can be shared as an explicit extension and formalization of geological legends (I emphasize this, but I'd argue Burns is getting at the same idea implicitly with his "chains").

Are you covering all of these (if you care to?)

Figure 1: I don't object to the figure. I'd argue that you do need to include in the body a brief discussion of how these errors "happen"
- are they in the black-box of method?
- do they in part arise because of the specific placement of data ie moving a part might testably (non black box) have consequences

→ a typology of errors is obviously too much, and likely impossible, but a sentence (even if just to say "too complex"?

RMH Parquer paper- p3.

p5 21-25 This is weak. A lot has been written on this. I'd either contract this to a sentence or do it justice by expanding it.

p6 4,5 geological "area". domain? area of common history?

6 interpretatuncd → interpretive?
process history. A geological process history includes...

9 , and rock type classification

18 An aside, but I'd argue that at least some mapping is intended to identify contradictions or gaps in extant geological theory. In this case a contradiction is desirable in the short term.

22 as well as fundational...

22 ↓ 26 Truth Tables... by jump here. should not be capitalized.

"these relations"? what is an object? } needs expansion and clarification

p7 14-17 give an example of such a global/local disparity?
(After polarity in (16).

24 It points roughly not exactly (can be 30° off,...)

27.28 if you are in the subsurface beneath a vent is it extrusive? (nit. pick, but...)

For this whole section I'd define vectors as roughly/approximately... pointing...

p8 10-17. This is tricky. Knowledge of most of the earlier vectors was grounded in locally observable field relations. In some cases metamorphic gradients may be quite abstract (they are not locally testable).
Is metamorphism an event? Or a mappable unit?
For example, is a local marble from regional metamorphism part of, say, a "volume that is at lower amphibolite grade" or is it a "marble". What is a metamorphic "unit"?

18 picky, but some structural geologists would map a fault volume.
eg a shear zone. or even brittle anastomozing networks
Just as you exclude kinematics, you may want to exclude fault "volumes".

erosion surface (here my reference to Cordonnier's early-stage work from that perspective.

fold volumes: again, abstract volumes. I get this is a placeholder but this is going to be very messy.

9 5, 9. Fabric. No, really elements? A fold hinge ≠ fabric to me.

15-16. Just an aside here, but if you are going this direction then in fairness you should cite Bons 1969, 1975 in your intro as he very directly addresses the fabric/time relation in his consistency work

20-21 Again a big leap internal to a paragraph.
Perhaps 1-2 s talking about topological relations like meets etc then use your examples as is?

25-26 reword. Also possibly expand. The current phrase implies this is the role. Is it? Or is it a role.

10. Perhaps in caption refer to what the volumes are in (d)
Speculative/arm waving: in e, a fault has ↑/↓ because it must be younger than boundary units. I see, though, why you have this.

-13-

p15 l 19 "Truth Tables" Argh in

16 f3. h. I dislike the arrow on fault. Perhaps ↓↓↓ ↑↑↑ and ↑↑↑ ↓↓↓ ??
It is not wrong but the singular arrow took time to mentally attribute...

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17 17→28 Not convinced I'd lump these all as "stratigraphic"

paleo: ... unless otherwise indicated?
(many fossils are general.). Not picky.

31. Cute math but without context. – either expand or remove.

p18 Truth Table. Again. Not going to rant again ☺.

13 here you pin down met. units as non-abstract (unlike fold volume).

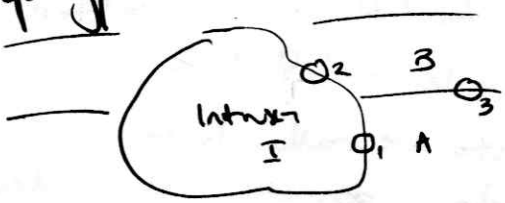
p 19 28-29. Ok, here, you do address my comment on pure generative frameworks. I agree that as volume incompleteness ↑ the space of models (well, combinatorics – yikes).

p20 20 Geodes-Solutions: is that a URL? Citation standard check.

~~12~~

p 23 F6 would be clearer if you just listed temporal relation not all #'s.

8-10. I guess. There is another way to look at this using a 3d extension of topology as seen in GIS. To illustrate in 2d.



Really we just need a graph that traverses the void: the dual graph of the (in this case 2d) topology, with labelled edges

Not sure if you can collapse binary relations, that math is needed. Of course, if you don't have labelled boundaries...

so perhaps expand 8-10 a bit: what is actually happening? What is big O consequence of the operations?

p24 F7 same complaint as F6.

29 F12 Truth table fragment

'see, it looks better without Table ii.

30 F13 Approximate scale of volume.

31 13-14 Is this area "inside" the volume? If so the chance of it being "noticed" or even "found" by inspection if an error was known but not situated is very small..

59 1-2 My gut feeling (...) is that this may also address situations of under-constraint: while very many models are possible, geological knowledge also suggests which are plausible. Dangerous ground to tread, though. Some people are working in that general area (C. Bond in particular). Epistemology of field geology...

General concluding comments

1) I'd like to see a very short (2-3 s?) appendix that provides more info on 'development, probably part of A1, in the 'Code and Data Available' area. The toolchain discussion in the paper is understandably terse.

2) While my notes on your intro are rather loose I do think tightening up the generate — test — communicate idea is worth doing.

I realize 'communicating legends' etc is not your goal but in many cases of complex models like your last case study pebkak and... well... that's a communication issue. I get your truth table approach, but it's not elegant in terms of immediately grasping relations (feel free to disagree, I spent 6 hours on this not weeks, but tbh are your users more in the 'few hours' or the 'intense study' camp?

3) Undoubtedly a "preprint" issue but a lot of figures (1, 2) could benefit from larger block models using the available space.

//RMH June 2024.