

Review. Parquer, de Kemp, Bodanic, Hillier
Consistency Checking 3D Geological Models

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

16 I'd argue the same could be said for human-led compilation efforts where
a) # of relationships " large
b) # of contacts that imply / require a geological order " 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 (# rel's, # poly) " manual inspection likely?

p 4 l4 implicit knowledge can vary... yes, I agree, but to introduce that here... are you sure no step in the model population's 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 600 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 → " 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.

An aside, but fuji, the procedural generation community (video game worlds) is beginning to look at geological history / 3d volumes / etc. via 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.

es Gaillardon et al 2024 Chalk 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 obvious 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 permissible (testable) map relations (in Burns these would be testable binary relations, in Harrap these would be adjacency relations that are consistently permissible 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 point might testably (not 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"?)

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

p6 4.5 geological "area". domain? area of common history?

6 interpretation → 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 foundational...

22 Truth Tables... by jump here. "these relations"? what is an object?

↓
26 should not be capitalized.

) needs expansion and clarification

p7 14-17 give an example of such a global/local disparity?

(Pater 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, e.g. a shear zone. or even brittle anastomosing networks. Just as you exclude kinematics, you may want to exclude fault "volumes".

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

fold volumes: again, abstract volumes. I get this as 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 Bani 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 1-2s talking about topological relations like meets etc then use your examples as is?

25-26 reward. 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/am waving: in e, a fault has \updownarrow because it must be younger than banding units. I see, though, why you ignore this.

-13-

p15 & 12 "Truth Tables" Arch in

16 f3. h. I dislike the arrow on fault. Perhaps $\begin{matrix} \downarrow\downarrow\downarrow \\ \uparrow\uparrow\uparrow \end{matrix}$ and $\begin{matrix} \uparrow\uparrow\uparrow \\ \downarrow\downarrow\downarrow \end{matrix}$??

It is not wrong but the singular arrow ~~took~~ time to mentally articulate...

17 17 → 28 Not convinced I'd lump these all as "stratigraphic" paleo: ... unless otherwise indicated? (may fossils are general). not picky.

31. Cite math but without context. - either expand or remove.

p18 Truth Table. Again. Not going to rant again :).

B here you pin down met. units as non. abstract (unlike fold volumes).

p 19 28-29. Ok, here, you do address my comment on p5 re generative frameworks. I agree that as volume incompleteness ↑ the space of models (well, combinatorics... yikes).

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

~~28~~

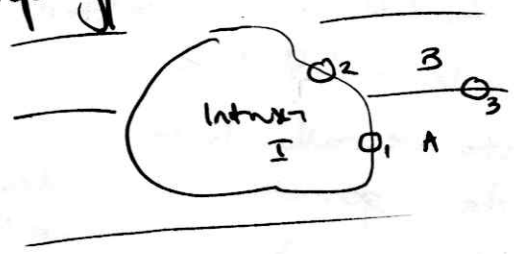
p 23

FG

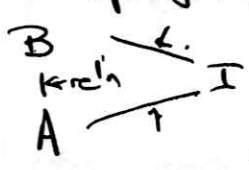
would be clearer if you just listed temporal relations not all #s.

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 MID: the dual graph of the (in this case 2d) topology, with labelled edges



Not sure if you can collapse binary relations, that mesh is needed.

Of course, if you don't have labelled bandages... -

so perhaps expand 8-10 a bit: what "actually happens?" what "big O" consequences of the species?

p24

F7 same complaint as FG.

