Consistency: Checking 3D Geological Models

16 I'd argue the same could be said for human led computation efforts.
   a) # of relationships is large.
   b) # of contacts that imply/requirt a geological order is large.

This leads to line 2 on p.34: With a truly complex situation
   (rela, rep. etc.) manual inspection likely?

p.4 14 Implicit knowledge can vary... yes, I agree, but to introduce that
here... are you sure no step in the model population process
didn't also? And perhaps computational also did too?

p.16 Not true but also not published > just an aside > using
Arc/View/ Avenue the Harrop 2001 method was
applied to checking 600 maps (with introduced
errors)... and of course never published it.

17 Range of knowledge, Actual
   Range of knowledge (e.g. example,...) perhaps.

125 I would argue now (having read Bunn after 2001) that
his vision of using it as a tool to formalize knowledge
in large areas > consistency while building > (1)
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 games etc.) is beginning to look at geological history/3d volumes etc. via a vis applying terrain erosion algorithms (Guillaume Gordonier...) and though their goal are different, in the long run this is another form of consistency work.

In your intro you almost read down what a consistency-check 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 Dorjes case)

2) As a generative framework: you can 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 Bims there would be testable binary relations, in Harrap there 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 legend (I emphasize this but I'd argue Bims is getting at the same idea implicitly when he 'chains')

Are you carrying 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 (e.g. moving a point right testably (or black box) have consequence)

- a typology of error 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 contract this to a sentence or do it justice by expanding it.

p6 4,5 geological "area" domain? area of current history?
   interpretation -> interpretive?
   process history. A geological process history includes...

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.

as well as foundational...

22 Truth Tables ... by jump here. "these relations"?

26 should not be capitalized.

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

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

27, 28 if you are in the subsurface beneath a vent
   is it extrusive? (not, pick, but...)

For this whole section I'd define vector as roughly/approximately...
picky, but some structural geologists would map a fault volume by 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 Co-danmier's early-stage work from that perspective.

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


15-16. Just an aside here, but if you are going this direction then in fairness you should cite Barn 1966, 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 is 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 (c) Speculative/amusing: in e.g. a fault has been because it must be younger than boudin units. I see, though, why you ignore this.

13-14 “Truth Table” Append in.

16 5-9. I dislike the arrow on fault. Perhaps 111 and 1111?? It is not wrong but the single arrow took time to mentally attribute...
Not convinced I'd keep that all as "stratigraphic"
  paleo... unless otherwise indicated?
  (may or may not apply).

Are math but without context—either expand or error.

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

here you pin down met. units as non. abstract (unlike field
  volume).

28-29. OK, here, you do address my concern on ps-re generative
framework. I agree that as volume incompleteness of the
  space of models (well, combinations... yikes).

20. gedes - solution: is that a URL? Creation standard check.

would be clearer if you just listed toped relation not all #5,

I guess. There is another way to look at this using a 3d extention
  of topology as seen in As. To illustrate in 2d.

so perhaps expand
  0.1 a bit: what if
  actually happen.
  What is log0 consequence
  of the specifics?

Really we just need a
  graph that traverses the unit:
  the dual graph of the (in this case 2d)
  topologist, with labelled edges
  B - C. Not sure, if you can
  trace it. I collapse binary relation,
  at least, that mesh is needed.
  Of course, if you don't have labelled
  binaries...
Truth table fragment

'...it looks better without Table 3.'

Approximate scale of volume.

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.

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. Danger ground to tread, though. Some people are working in that general area (e.g. Bond in particular). Epistemology of field geology...

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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 technical discussion in the paper is understandably terse.

2) While my notes on your intro are rather loose
   I do think tighten up the 'generate idea' worth doing.

    test - communicate

    I realize 'communicate legend' are not your goal but in many cases of complex models like your last case study, people and... well... that's a communication issue. I get your truth table approach, but it is elegant in terms of immediately graspable relations (feel free to disagree, I spent 6 hours on this not weeks, but they are your users more in the 'few hours' or the "future study"

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

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