Minerals geophysics

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Colour me red

In modern times, spectacular developments in geophysical processing, interpretation and presentation technology have changed the role of geophysicists. Geophysical data presentations used to be quite basic – typically contours and sections of the survey results themselves, perhaps with some simple modelling. Because of this, and the arcane knowledge needed to understand the processes involved, only geophysicists interpreted geophysical data. Not anymore! Now we have a powerful array of processing and interpretation tools – think constrained 3D inversions for example - and a wide spectrum of presentation options to draw upon. Thanks to these, geophysical survey data are now much more clearly related to the geological environment they seek to investigate. Geophysical survey results are no longer the province of a select few, but are accessible and usable by all geo-scientists.

In particular, in the matter of image presentation, the range of options available to us is impressive. We can now image results (often inversions or purpose-built algorithm products) to emphasise (or de-emphasise) pattern elements, strike directions, anomaly styles and magnitudes, etc.

As a simple and basic example, I'd like to focus on colour tables, and more particularly on colour stretches. The potential for problems was first brought home to me after poring over a regional magnetics image with an exploration manager, identifying magnetic anomalies of interest in a general targeting exercise. However, on reprocessing that part of the image covering our area of interest, most of our targeted magnetic anomalies diminished alarmingly – casualties of the colour stretch. Now I insist on fully descriptive titles and colour bars for all images!

The impact that colour stretches can have is well-illustrated in the following example. We were surveying an area looking for extensions to known structurally controlled mineralisation. The survey results as delivered by the

contractor were quite spectacular (see Figure 1); the known mineralisation, on the bottom margin of the map, had responded well, and there were strong indications for similar mineralisation within prominent structural trends through the area. However, the colour stretch used was histogram equal area, the default option in many imaging packages because it requires no operator intervention and produces attractive maps. By way of contrast, the image produced using a simple linear colour stretch was equally spectacular (see Figure 2), but for all the wrong reasons. The mineralisation-related response remained, but all other responses in the survey area were seen to be nowhere near the required magnitude. All our new 'mineralisation' had vanished! As a simple compromise, I settled for a clipped range linear image (see Figure 3) which emphasised the absence of other significant responses, but did retain the structural information, albeit, unfortunately, un-mineralised. The message here is that, by their very nature,

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histogram equal area colour stretches will always deliver a significant proportion of apparently anomalous responses (i.e. coloured red), no matter what the actual response magnitudes are.

So, along with these powerful new visualisation tools, come new responsibilities for the geophysicist. At the touch of a button we have the means to strongly influence how the results are visualised. And, perhaps worryingly, modern software now gives other geoscientists the ability to apply their own colour stretches to 'our' data. So, some education may be in order.

Finally, I have to confess that occasionally I've let this new-found power go to my head. I once created a soft fluffy pastel colour stretch (think English rose pink through to powder puff blue and you'll get the general idea) for a particularly macho geologist in our team – he was not impressed! Such is the power of modern computer processing.

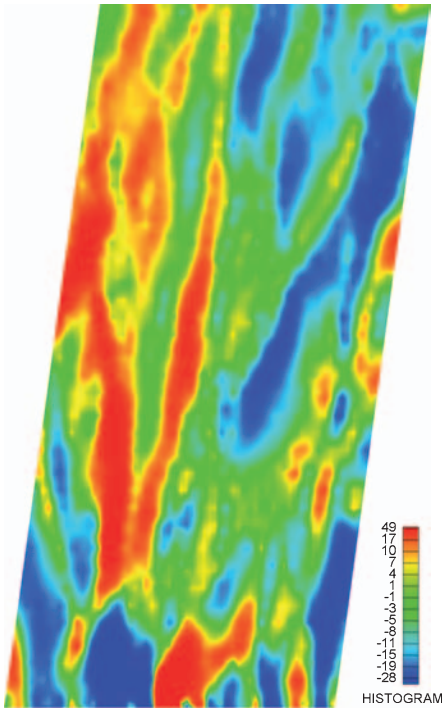

Figure 1. *Histogram equal area colour stretch.*

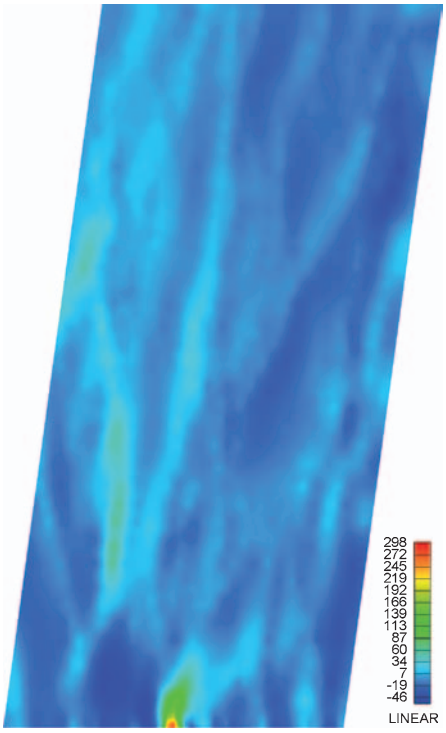

Figure 2. *Linear colour stretch.*

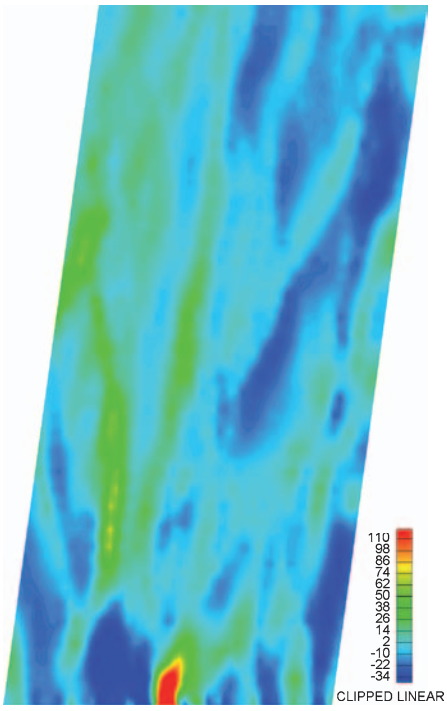

Figure 3. *Clipped linear colour stretch.*