

Rationale for the VGM algorithm

Below is a brief background to the rationale behind the VGM decompression algorithm and its validity in technical diving.

Decompression from common sports and technical dives

We know from experience that common dives to a round 30m do not require the type of decompression that VPM or gradient factors of say 20/80 would advise. Bühlmann and Navy tables are reasonably reliable to these depths and short durations.

Contrast this with an 80m technical dive. With VPM and modern research, it has been shown there is now a need to do deep water stops.

So why is there a difference? There are scientific papers on this, but my feel for this has, as much as anything, come from a chance remark when talking to Phil Short. We were looking at a typical VPM decompression for an 80m 30min trimix dive. He instinctively described the first half of the stops as decompressing the bottom time, and the second half of the stops as decompressing the first part of the decompression. It was as though there were two dives to be decompressed. One might consider even deeper dives to have even more pseudo dive sections.

So the 30m dive only really has one decompression. The extra decompression that would be required using VPM, is not necessary as the body and bubble growth is stabilised shortly after the initial decompression, because the diver gets to the stable condition of the surface relatively quickly.

However, for the 80m dive, the diver has to manage the initial micro bubble growth more properly, as his body will be subject to considerable further tissue pressure difference exposures as he/she ascends through each of the decompression stops. There is no swift stabilization of pressure. Bubbles have to be managed much more carefully because of this instability and continued exertion. (Micro bubbles, arterial bubbles and large bubbles all have to be treated carefully).

It is as though the decompression path becomes not only longer and longer, but also narrower and narrower with increased depth and bottom time. The fact that it becomes narrower suggests a need for more conservatism in the decompression. You might run down a wide road with a precipice either side, but would you run down a narrow path in the same conditions? A decompression for an 80m dive may now be relatively common and even standard, but the diver still has to be careful not to over exert himself after the dive. Rest is the best. We know the body may feel alright when surfacing after one of these dives, but DCS can be brought on by exertion etc..

So when doing deeper and longer dives, the body is exposing itself to a higher potential for triggering DCS. Thus extra conservatism is needed to give flaws in the body, or exertion or stress the chance of being coped with without DCS. Deeper dives in themselves are more stressful, so decompression tables can not just be extrapolated. They have to take into account that the likelihood of creating conditions for DCS to manifest itself, are increased as well. Not just more gas loading, but also more chance of that gas loading causing DCS..

One can extrapolate the path analogy such that at some stage the path becomes a tightrope. The care required to traverse the decompression increases.

And fitness does not make the need for decompression diminish. Paraphrasing Billy Deans – decompression is not something you can train for – you can not train your body to require less decompression. (You can however damage your body so that it requires more..)

So what does VGM do?

VGM takes account of the reliable data and experience of the sports and technical divers. It uses this data to create a change in style and increase in conservatism of decompression stops, moving from what we know works for shallow dives through to what we know works reasonably well for common technical dives down to around 120m.

For a few years, divers have used different gradient factors to achieve this change in style, manually adjusting gradient factors of Haldane models to suit the dive they are planning. VGM does a similar thing, but modifies the over pressure tolerances of the different tissues that control the various stop depths and durations. VGM modifies these tolerances based on increased depth and bottom time so that the diver does not have to. The equivalent gradient factor is shown during and after each dive. This gradient factor will change depending on the bottom depth and time for each dive. The user can further manually adjust the factors modifying the different tissues to achieve a decompression that suits his or her experience and body conditions.

Note – VGM also modifies mid range tissues separately to fast and slow tissues, achieving adaptation of mid range stops separately to deep or shallow stops. Extended mid range stops are a common technique used on deep dives to allow surfacing with a lower bubble count than would otherwise be expected – Britannic 1998 exploration is an early example of this technique.

Because VGM can modify midrange tissues, the equivalent gradient factor, which considers a linear change from the first stop to the last stop, will not be wholly accurate. It will however be a good indication.

Summary

VGM takes the over pressure tolerances acceptable for shallow, short dives and modifies them to those required for 120m or long dives, as the bottom depth and duration are increased. This technique has achieved decompressions already in common use for all dives in the 0 to 120m range.

So, with VGM, we now have one decompression model that fits all dives in this range. (Note: Diver specific adjustments must still be made as suggested for unfit or smokers etc..) VGM allows further safety to be adjusted by the diver to create a schedule that suits his/her experience.

Nick Bushell
8th October 2008