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## Global methane emission through mud volcanoes and its past and present impact on earth climate

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### The problem

After having re-read all the relevant literature on methane emission by mud volcanoes and after having recalculated my own flux estimates, it looks as if the problem with these papers are not the variations in total numbers, but the importance the authors assign to their numbers.

Clearly, Milkov and Etiope (hereafter ME) have no trouble finding clauses in my paper wherever they feel they may have been misunderstood or misquoted. Equally, I could list sentences in their Comment, or in some of their earlier papers for that matter, where they err or “assign inaccurate meaning” to certain aspects or numbers. Rather than undertaking the tedious exercise of listing such errors, I comment on the Conclusions section of their Comment. There, the authors claim that several methane emission estimates from mud volcanism gave similar results while my range of results is both too wide and, for its upper limit, too high.

It is not surprising that some of the estimates by mud volcano researchers are similar, because some workers did not create their own database, but used an existing one [e.g., Milkov et al. (2003) used that of Dimitrov (2002)]. By contrast, I had created my own database when writing a comprehensive review paper a couple of years ago (Kopf 2002). While doing that, I read in excess of 200 publications on mud volcanoes and noted down all the information on size, activity, gas composition, and—if available—also the methane emission rates. Consequently, that database has correctly been called the most comprehensive one in the paper in question

(Kopf 2003). Moreover, my calculations have been made on these numbers of mud domes, and are hence conservative given the possibly large number of yet undiscovered seafloor mud volcanoes, and also when compared to work where the authors infer mud domes by the thousands (no reference here, but both those who did as well as the experts in the field know which estimates are meant).

I admit, however, that in the follow-on calculations, there are uncertainties, as there are inevitably in any study of this type. Still, I strongly object that ME repeatedly termed them as “mistakes”. As ME have correctly identified, there are assumptions made in Table 2a and c regarding the flux of some mud features, and of course these assumptions are carried through to Table 3. The assumptions are a matter of debate, however, they are not a priori mistakes, as ME bluntly state. They are possibilities, as any global (or other) estimate represents a possible scenario. Not more, but also not less!

In fact, the wide range of results presented from the methane emission estimates result from (i) the large mud volcano database and (ii) the wide range of sometimes poorly constrained gas flux data. This does not necessarily mean that the use of such data for a global estimate is a fruitless effort, even if the uppermost values exceed the total atmospheric methane flux, at least at present, and if  $^{14}\text{C}$ -free methane is regarded (which of course is based on another assumption...).

### The answer

To me, the lesson to learn from such an exercise is twofold. An apparently unlikely result from a complex global estimate based on assumptions which are sometimes harder and sometimes not so hard to justify is not necessarily in vain. As long as it is received with an open (rather than a dogged) mind and the according attention and expertise, that is.

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**References**

- Dimitrov LI (2002) Mud volcanoes—the most important pathway for degassing deeply buried sediments. *Earth Sci Rev* 59:49–76
- Kopf A (2002) Significance of mud volcanism. *Rev Geophysics* 40:10.1029/2000RG000093, p 52
- Kopf AJ (2003) Important global impact of methane degassing through mud volcanoes on past and present Earth climate. *Int J Earth Sci* 92(5):806–816
- Milkov AV, Sassen R, Apanasovich TV, Dadashev FG (2003) Global gas flux from mud volcanoes: a significant source of fossil methane in the atmosphere and the ocean. *Geophys Res Lett* 30:10.1029/2002GL016358, p 4