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Dear Kateřina,

Please find below my written report of the Ph.D. thesis **“Identification of microbial pigments in evaporates using Raman spectroscopy: implications for astrobiology”** by Mgr. Petr Vitek

Overall this is a very well written thesis. Chapter 1 (Introduction and rationale for research) is clearly written and contains an excellent survey of the literature pertaining to this project shown by the tremendous coverage of general science high impact factor publications (that is, *Nature* and *Science*) and more specialized journals (for example, *Journal of Raman Spectroscopy*, *Astrobiology*, *Planetary and Space Science* etc) extremely relevant for this research were reviewed. In addition, the aim and more detailed objectives were very clear and an excellent case was made why this research needs to be undertaken. The work shown here provides vital finding for ESA and NASA combined miniaturized Raman systems for astrobiological prospecting. Moreover, this chapter and the rest of the thesis outline how novel this research is, thus making this research an ideal candidate for a PhD thesis.

In terms of an overall impression on competence in technical and conceptual data analysis the student shows a high understanding and capability. I am impressed by 4 publications arising thus far from this research and more impressed a further manuscript is either in preparation or recently submitted. In fact this student has done such a great job that I recommend another manuscript that would be greatly accepted

and appreciated by the scientific community would be a good solid review paper summarizing the earlier work and this excellent new work.

Overall the science and methodology undertaken in this thesis is solid. I have no queries about any of the methods and conclusions drawn from this piece of research. That said, however, I have a few aspects where I feel there could have been more discussion in the thesis.

Firstly, it is stated in the thesis that using 514.5 nm excitation, would only enhance one carotenoid in a mixture of carotenoids under resonance Raman conditions. Although, Petr Vitek is probably right in stating this I would however, like to see an explanation accounting for this with respect to resonance Raman and non-resonance Raman conditions in the spectral acquisition of carotenoids and why only one carotenoid out of a mixture would be enhanced.

Secondly, the acquisition of Raman images using Streamline™ technology should be explained. There is very little explanation of this new improved imaging technique in the thesis. Significantly, this technique is relatively new and this could possibly be one of the first Ph.D. thesis's submitted utilizing this approach. This technique is vastly different than conventional Raman mapping techniques and should be better described particularly giving the novelty of this technique.

Thirdly, it is stated in the thesis that halite does not have any Raman active modes – this is true but again I feel this should be explained why halite does not have a Raman active mode. Particularly since this thesis is of great use to the broad astrobiology community some of these details should be described a little more thoroughly for the non-Raman spectroscopist reading this work.

Fourthly, explanation needs to be provided as to why the halite compromises the β -carotene signal at low concentrations.

Lastly, on page 44 of the thesis, explain your personal observations. I feel that these should be written in the thesis. This is extremely interesting work and I would have enjoyed reading about these observations.

In conclusion, I highly recommend that this thesis be awarded with the degree of Ph.D. I enjoyed reading the document – it was very well written. Moreover, I enjoyed

the science and I cannot stress enough how important these finding are to the ESA and NASA miniaturized Raman spectrometer programs. I would like to congratulate the hard/ good work put in by Petr Vitek. A great job!

Sincerely,

Craig P. Marshall