

# Discussion of paper by J. M. Stewart entitled 'Heat transfer and limiting physiological criteria as a basis for the setting of heat stress limits'

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I have read with interest all the papers dealing with heat transfer and the setting of heat stress limits that have appeared during the past two decades. Scientifically speaking, most of them can be rated as being of a high standard, and some of them have been acclaimed internationally as masterpieces of logical and calculated reasoning. The paper by Mr J.M. Stewart is probably no exception. However, it has prompted me as a practical physiologist to raise a few queries.

Fundamentally, I am not opposed to the concept of calculating heat stress limits based on the physical principles of heat transfer, but I am dismayed by obvious generalizations and assumptions that cannot be justified. For instance, the author states in his introduction that the primary objective of his paper is 'the development of reliable limits of heat stress for men working in South African gold mines', and he concludes that he has succeeded in his efforts. Yet, I venture to state categorically that the proposed limits are not valid for most of the mining conditions or for the majority of men working under them, and hence are unacceptable for use in the mining industry.

I say this for the following reasons.

1. South African miners do not work in the nude, their skin surfaces are not always completely wet, and they do not always move around in a state of thermal equilibrium. The major calculations involved in the derivation of the proposed limits centre on these assumptions.
2. Our miners are not nearly as highly acclimatized

as was the small number of subjects used to obtain the data for the said calculations. An idea of how well-acclimatized five of these subjects were can be obtained from the paper by Wyndham *et al.* in *J. Appl. Physiol.*, vol. 20, no. 1, 1965, pp. 37-45. The specificity of heat acclimatization has been ignored entirely by Mr Stewart.

3. Before any heat stress limit can be accepted, it must be evaluated by practical application and experimentation. Mr Stewart failed to do this, and consequently there is no guarantee that his proposed limits would prevent heat stroke even in nude acclimatized subjects.

South African proponents of limits of heat stress have had a field day for the past few years. Recommendations have been made for the adoption by the industry of these limits, and this has led to considerable confusion. For example, the very same arguments and data originally used to denounce the use of wet kata temperatures are now employed to defend and boost it.

Finally, I would like to express my great concern at Mr Stewart's suggestion that heat acclimatization practices could be replaced by 'a practical procedure for controlling the work rate of unacclimatized men during their first few weeks of work underground'. This very concept was practised by the industry up to the time that scientific heat acclimatization procedures were developed in 1952, and it contributed not only to low productivity but also to most of the heat stroke cases. I wonder how applicable the proposed 'heat stress limits' would be if the standard of acclimatization were lowered so drastically.

\* *J. S. Afr. Inst. Min. Metall.*, vol. 81, no. 8, 1981, pp. 239-251.

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