

STAVROS BANDIS 1951-2016

With a heavy heart mixed with unfading warm memories we must report the sudden death of Prof. Stavros Bandis, who was at work in the University of Thessaloniki on 11th January 2016. He died of sudden heart failure. He was head of the department and Chair of Rock Mechanics and Civil Engineering. His many past and future students, and his staff, have suffered a very great loss. Two who have also had long association with him, Dr. Nick Barton and Dr. John Sharp, have provided these images of his important contributions to rock mechanics and rock engineering, on behalf of ISRM.

Nick Barton was first contacted by Stavros when he was a Ph.D. student with Prof. Dearman, in Leeds University: Out of the blue in 1978 or 1979, Stavros wrote a detailed, beautifully illustrated, and several page letter in his inimitable italic hand, with his latest research on scale effects in rock joint replicas. By good fortune for those in rock mechanics who value an alternative to Mohr-Coulomb for describing rock joints, he was already making thorough use of JRC and JCS, as recently detailed with shear tests, tilt tests and profiling, in Barton and Choubey, 1977. His thesis of 1980 *'Experimental studies of scale effects on shear strength, and deformation of rock joints'*, was soon awarded a highly deserved (5th) Rocha Medal by the ISRM. Bandis's superb research helped to set the scene for the development of the Barton-Bandis joint behaviour criterion. The recommended scale-effects for JRC and JCS, which are block-size dependent, were derived from his and the writer's physical model and jointed rock experiments. Bandis alone was responsible for the hyperbolic normal closure and stiffness behaviour. By 1982 the Barton-Bandis model, with physical and conducting apertures included, was up and running in TerraTek, Salt Lake City (thanks to Dr. Khosrow Bakhtar's programable HP-calculator expertise).



Relaxing between book writing duties. ('Engineering in Jointed and Faulted Rock' should be completed in 2016, thankfully with the two intended authors).

In 1985, Mark Christianson of Itasca installed BB in Peter Cundall's UDEC, of course with some assistance from Bandis since he was with us at NGI at the time. We immediately applied UDEC-BB to the Ekofisk reservoir compaction (and joint shearing) study. Bandis was actually the first to test Ekofisk joints for their shear strength, after Philips had been surprised at the writer's NGI request for jointed core samples.

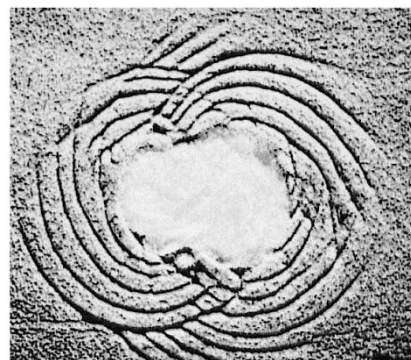
We had the pleasure and great benefit of several visits for summer and sabbatical work by Stavros at NGI, perhaps most notably during a physical model study of 3D borehole/wellbore stability and failure, conducted for various oil companies in the late 1980's. The most detailed study of log-spiral failure patterns, for holes drilled in various directions in relation to applied 3D stresses, was strongly contributed to by Bandis, including a personal (anisotropic) gift to the project manager, shown here, and carefully preserved in my Oslo office. (See Addis et al 1991, SPE for project details).

In 1990 we held the Rock Joints conference in Loen, and naturally Bandis was one of the keynote lecturers. A gathering of rock mechanics friends prior to this event, also illustrated here, includes ISRM president John Franklin, 1987-1991. The ISRM has also lost Prof. Kawamoto in the intervening years.

Stavros Bandis, as you will read from John Sharp, had an uncanny wish to achieve reality when characterizing and then modelling rock mass and rock excavation behaviour with UDEC-BB or 3DEC. His modelling work was outstanding and has probably not been matched due to his constant attention to detail. As his friend and colleague John Sharp has written: 'His loss as a world leader in his field with such an enormous insight and depth of knowledge is unaccountable. He spoke to everyone as an equal, with interest and humour, always making a substantial and yet understated impression.' A selection of his many contributions will be included in our joint book-project, which has been progressing for the last four years, during chapter-by-chapter sessions, mostly undertaken in a deserted village high in the Greek mountains, cut off from the internet.



An example of Bandis's quest for reality, in this case anisotropic behaviour, to contrast with isotropic log-spirally failing model wellbores. Here he proved that shearing was occurring using coloured sand in miniature pre-drilled boreholes.





From left (ISRM only): Pinto da Cunha, Bandis, Makurat, Franklin, Johanson, Martin, Aydan, Barton, Kawamoto, pictured in 1990 prior to the Loen conference of Rock Joints. Sadly, three are now departed.

Sadly, Stavros is no longer in the University of Thessaloniki, but he left behind a team of expertly trained and gifted colleagues who will attempt via his inspiration to continue his unique legacy and reputation for geologic inquisition, realistic simulation and applied engineering solutions. Stavros leaves his wife Christina, and two adult sons Konstantinos and Nickolas.

Nick Barton, March 2016