

Alec W. Skempton and Laurits Bjerrum

A long-time friendship between Imperial College and NGI

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Abstract

The paper presents a light-hearted insight into the close relationship between Imperial College and NGI, mainly from notes of Laurits Bjerrum and through the correspondence between Alec W. Skempton and Laurits Bjerrum over 20 years (1951-1972). The correspondence was both technical and personal, with discussions of hypotheses of soil behaviour, planning of lectures and debating the future of the International Society. Skempton and Bjerrum were two giants, each leading growing organizations and inspiring each other from afar.

Prelude

This contribution only provides partial insight into the lives of Alec Skempton and Laurits Bjerrum and how they shaped Imperial College's and NGI's future. It would be pretentious of the authors to attempt to give more than a fragmented view of Alec Skempton to an assembly of persons who knew him much better and shared his life for up to five decades. Nevertheless, we hope that these short vignettes of Skem's life, as they relate to Laurits Bjerrum and NGI, will interest the reader.

NGI-Imperial College 1950-1973

When setting up the strategy for the new NGI, Laurits Bjerrum drew on the experience of research organisations from abroad, in particular the Building Research Station in the U.K. In the 50s, Bjerrum called upon his friend, Alec W Skempton, formerly from BRS, then at Imperial College, for inspiration. With this input, Bjerrum and NGI decided to focus on:

- development of field and laboratory equipment and of site investigation methods,
- theoretical developments and analysis to predict soil behaviour,
- field measurements and observations of stress and deformation.

Laurits Bjerrum, in a lecture at MIT in 1957, described the steps required to develop a young research institute. At that early date he was already describing the core of today's NGI:

"(...)

- combine research and consulting work; do not separate them because dividing up research and consulting always 'kills' research; consulting is necessary in order to learn where the problems are and to collect experience,
- spread activities, include jobs from abroad,
- follow up projects,
- employ people with a varied background, people with intuition and with ability to work across professional boundaries,

- keep in contact with developments in foreign countries and their publications,
- maintain a good working relationship with clients."

The Skem-Bjerrum friendship started at the International Conference in Rotterdam in 1948. There Alec and Nancy Skempton and Laurits and Gudrun Bjerrum first met. Skem and Laurits were nearly the same age, Skem being older than Laurits by four years. In Rotterdam, Laurits was very eager to meet 'this fellow' called Alec Skempton from Imperial College. Bjerrum had "tons of geotechnical questions" to ask to Skem (*dixit* Gudrun Bjerrum). Apparently, it was difficult to stop the young Danish engineer talking, because after a while Skempton turned to Alan Bishop and asked him to take over answering the questions.

At the next international conference in Zürich in 1953, the friendship between Alec Skempton, Ralph B. Peck and Laurits Bjerrum, which soon would develop into an exceptional relationship, started over a dinner arranged by Bjerrum, with Skem providing the wine. Skem later said:

"That evening remains in my mind as perhaps the most enjoyable and fruitful I have ever spent. (...) Later on the same trip, all three of us had another wonderful evening, with Hvorslev, as a result of which I determined to apply effective stress analysis to the London clay slopes. In arriving at this decision, which at the time seemed as almost far-fetched, I was encouraged, or even prompted, by Laurits." [Quoted in Niechcial (2002) p. 90].

The kinship between Ralph Peck and NGI remains strong, as NGI today houses the Peck Library beside the Terzaghi Library.

Later, Skempton would write of the tall Danish engineer, Laurits Bjerrum:

"I was immediately impressed by his vivacity, by his knowledge and intellectual discipline and, above all, by the combined charm and firmness of his character... From the time of the shear strength conference until he died, he and his work were never far from my mind. I was frequently seeking an opportunity to discuss new ideas and new discoveries with him and looked forward with the keenest anticipation to hear of his latest research... among the many interests which to our delight we found we shared was a devotion to the beautiful work of Juul Hvorslev" [Quoted in Niechcial (2002) p. 86]. According to Skem, Bjerrum grasped and analysed technical problems very quickly and asked the right questions. He could be very firm with his staff and would take the lead in any situation.

As early as 1954, Skem and Nancy visited Oslo and NGI. Skem called Laurits the "inspired" NGI director. Skem found NGI a "tremendous place, buzzing with work and new ideas" (Niechcial, 2002). It was exciting for Skem to discover the parallels between the Norwegian clays and the post-glacial clays in England and to find such a kindred spirit in Laurits Bjerrum.

Imperial College and NGI, through their leaders, had long and intense technical discussions, generally at Imperial College, about the fundamentals of soil mechanics and the behaviour of clays. This was supplemented by frequent exchanges of letters, where they shared technical ideas, planned trips and meetings, arranged technical sessions at conferences, discussed the promotion of fellow professors and even plotted together, for example regarding the election of Arthur Casagrande as President of the International Society in 1961, celebrating Hvorslev's 70th year on December 25th 1965, and discussing where the secretariat of the International Society should be located (London or Oslo).

Skem and Bjerrum agreed on the importance of promoting the study of Engineering Geology in the university curriculum. In the early 50s, they even discussed the optimum number of issues in one year for the new journal *Geotechnique*!

In 1962, Skem proposed that our international society be called the 'International Society of Soil and Rock Mechanics and Foundation Engineering'. Skem and Laurits spent a lot of time in the early 60s discussing the purpose of the International Society, and including Rock Mechanics within it, involving also Albert Caquot in the discussions. They agreed that the integration should be done. The correspondence does not document why this was not to be.

Together and in many intangible ways, Skem and Laurits influenced the development of not only Imperial College and NGI, but also the rest of the profession.

Their correspondence was intense throughout the 60s. In the letters, one can find a number of ideas on the results of *in situ* and laboratory tests in clays, and even the original tabular results. Each liked to have his ideas checked by the other. They were ahead of their time, using each other to provide quality control of their work as progress was made. The correspondence ranged from peat to stiff clays, the Pisa Tower, the Vaiont slide, and even the effect of sand grains and fragments of shale embedded in Drammen clay. Skem would take NGI's research reports, fit a best line through the data, and send back the equation to Bjerrum asking for his opinion.

When Skem wished to use proprietary data, Bjerrum would suggest: "Most of this material is confidential, but I am pretty sure that we can find a way of shaping it such that we do not come into conflict at any time, at least for the purpose of which you are making use of the material". In 1968, Skem asked Laurits if NGI could take samples at Lodalen, where a slide had occurred, and measure the residual shear strength; and, by the way, "what was NGI's experience with the ring shear apparatus?" – all of which was duly responded to within one week, in long letters by either Bjerrum or someone on the NGI staff. The Skem-Bjerrum correspondence also provides, for example, a full documentation of how the ring shear apparatus was developed, one of the important collaboration projects between Imperial College and NGI.

Skem was concerned that Bjerrum was overexerting himself, with NGI, lecturing and international consulting projects. In a letter in April 1968, Skem wrote: "Bishop is writing to you about a lecture at College. I would only add that while we would be delighted to hear you give a lecture, please don't feel in any way obliged to give one."

Bjerrum and Skempton collaborated in the edition of one book, "From Theory to Practice in Soil Mechanics - Selections from the writings of Karl Terzaghi". Arthur Casagrande and Ralph B. Peck were the other co-editors. Skem wrote on 'Terzaghi's discovery of effective stress', while Bjerrum wrote on 'Terzaghi's method of working'. Surprisingly, no correspondence between Skem and Bjerrum can be found about this work. This lack of communication may reflect the difficulty the authors experienced in writing the book (Goodman, 1998).

Skem and Bjerrum, Imperial College and NGI shared a great admiration for Karl Terzaghi. Ralph Peck gave the 1st Terzaghi Lecture in 1964, Laurits gave the 3rd in 1966. We have often wondered why Alec Skempton did not give a Terzaghi Lecture. Skem is one of the few, among our great pioneers, missing in the list of Terzaghi lecturers. We noted also that 1972 is the only year without a Terzaghi Lecture. The Skem-Bjerrum correspondence shows that in May 1971,

Alec W. Skempton was asked to give the 1972 Terzaghi Lecture. Skem wrote a letter to Laurits asking for advice. Laurits replied to Skem in a handwritten letter, as annotated on the original letter from Skempton, but there does not seem to be a copy of the response at NGI today. We have concluded that Skem, for some good reason, was not able to accept to deliver the Terzaghi Lecture in 1972, and that the missing lecture in the series of now 40 Terzaghi Lectures should have been Skempton's.

The 4th and 7th Rankine Lectures

Skem gave the Rankine Lecture in 1964, Laurits in 1967. Each contributed to the other's lecture, also by going over each other's slides the night before the presentation.

Two weeks before his lecture in February 1964, Skem wrote to Laurits: "What I suggest is that we run through the lantern slides here on Tuesday afternoon. This would help me, and it would give you a good idea of what I am going to talk about." After his stay in London, Laurits thanked Skem for his hospitality and said how much he had enjoyed being part of the Skempton family during that week.

Laurits Bjerrum had been asked to prepare the vote of thanks to Skem for his Rankine Lecture. He said (excerpt of written version of Bjerrum's vote of thanks):

"Dr. Skempton deserves to be complimented for having selected a topic for his lecture which concerns one of the fundamental and central problems in soil mechanics. And he deserves no less credit for doing this in spite of the fact that stability of slopes is probably one of the most complicated and difficult problems. (...)

"It may serve as an illustration of Dr. Skempton's thoroughness that in the period he worked on the Norwegian case studies we had a selected group of engineers working on answering the questions in Dr. Skempton's letters, giving an account of even the most minute details, including for instance the anatomy of the small animals which got buried in the clay during its deposition. (...)

"It gives me a welcome opportunity to emphasize one of Dr. Skempton's greatest contributions. And that is to bring order into the picture: to formulate simple and intelligible principles and to draw up the limits for their applicability. (...) I express our deeply felt gratitude to Dr. Skempton for having guided us through the jungle of apparently unrelated observations with which we so frequently are faced in soil mechanics.

"The ability to bring order into matters is based on a number of unusual gifts. Imagination and intuition are needed to see possible correlations and formulate alternative working hypotheses. Courage is required for rejecting irrelevant considerations while accepting those believed to be essential. But first and foremost is required a very thorough and intimate familiarity with and feeling for the fundamentals of the problems to ensure that the conclusions are deeply anchored in sound basic principles. Persons gifted with these abilities are, not surprisingly, very scarce. It is extremely fortunate that we in the present period of very rapid development have in Dr. Skempton such a gifted person in our midst.

"We should appreciate (...) the great impact Dr. Skempton's work has had on our science on a world scale. (...) I am perhaps qualified to make this statement, as I have received so much stimulus and inspiration from Dr. Skempton. In addition I am sufficiently familiar with the conditions in Europe and in the United States that I know the influence Dr. Skempton has had on the development of our science all over the world."

To the text of his vote of thanks, Laurits Bjerrum had attached his handwritten notes from the lecture, with questions on the ultimate shear resistance in slopes in stiff fissured clays, the use

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of ϕ' for the calculation of N_{ϕ} , the importance of the correct evaluation of the shear strength and the function of continuous slickensided fissures etc. No doubt these topics ended being the start of animated discussions that same evening, as witness several sketches of slopes and pore pressures accompanying this unpublished text of Laurits Bjerrum. NGI (Bjerrum and Kjærnsli) sent to Skem a full set of comments (several pages with drawings) on the manuscript of the 4th Rankine Lecture. These were carefully addressed by Skem in the final version of the paper in Geotechnique.

In 1967, Skem chaired the proceedings when Laurits Bjerrum gave the 7th Rankine Lecture. Their destinies seemed to be constantly intertwined.

Back in Oslo after delivering his Rankine Lecture in 1967, Bjerrum wrote to Skem:

"Thank you so much for your hearth-warming letter dated 21st February. I appreciate your comments on my Rankine Lecture very much. I cannot tell you how much I enjoyed on my side to have the opportunity to discuss with you the problems, and your general acceptance the day before the lecture was a great stimulus.

"The c_0 - p_0 line for the Drammen plastic clay was drawn on the basis of the enclosed table, ..."

and the technical discussion started in London continued from the Oslo office as if they were still sitting together face to face in Skem's office at Imperial College.

Colleagues and friends

Gudrun Bjerrum, Laurits' spouse, remembers:

"Skem and Laurits were on the same wavelength. They had the same sense of humour, it was like a ping-pong exchange between them, they laughed such that tears were running on their cheeks. They would discuss using very strong voices, but they respected each other. Their friendship was close. At the start of the relationship, Skem had difficulty remembering Bjerrum's family name. He used to say: 'think Bier and Rhum' " (reported by Gudrun Bjerrum).

In one of its last letters to Skem, Bjerrum asked Skem to provide him with his picture. Bjerrum writes: "I am trying to update my collection of photographs of great contributors of Soil Mechanics, and I discovered to my great surprise that I do not have a photograph of you!" A request to which Skem promptly replied.

Of course Skem did not like to travel, but Laurits loved it! So the two were complementary in this respect, and Laurits would never miss an opportunity to drop in on Skem at Imperial College.

The Skempton and Bjerrum families were close, spending vacations together. The daughters, especially Annette and Katherine, got on well. The Skemptions would stay with the Bjerrums and vice-versa. They went on sight-seeing trips together. According to Judith Niechcial (2002) "Bjerrum and Skem were as close as Skem got to anyone." They even exchanged Christmas gifts, mainly Norwegian chocolates from the Norwegian side ("enormous box of chocolates" says Skem in his thank-you notes).

Nancy and Gudrun were best friends at the interminable conferences in exotic and less exotic locations. They also had a common interest: bookbinding. Gudrun recalls: "I was a novice, but Nancy was a professional, an artist really! Nancy was very talented, she was extraordinarily sweet; she was a warm person, but quite modest" says Gudrun today.

When Laurits Bjerrum died in 1973, Skem wrote to Gudrun Bjerrum:

"I shall always remember Laurits as my dearest friend and the greatest man in soil mechanics after Terzaghi. My life was made happier and more interesting because I knew him".

We imagine that Laurits Bjerrum might have written the same to Nancy Skempton under similar circumstances. In the tribute to Laurits Bjerrum in *Geotechnique*, Skem wrote that meeting Laurits and his wife was one of the great pleasures of his life.

The friendship between Nancy and Alec Skempton and Gudrun Bjerrum continued after Laurits' death, although they did not see each other often, and the letters gradually became less frequent. In 1982, Skem sent a copy of his book to Gudrun "A bibliographical catalogue of the collector of works on soil mechanics 1764-1950", with his and Nancy's love and best wishes.

NGI-Imperial College 1973-2003

Since the mid-seventies, the collaboration between Imperial College and NGI has been less intense, although the staff from the two organisations are still interacting with each other and enjoy each other's collegial and social company. NGI staff enjoyed Skem's company in his later years, albeit infrequently. The International Conference in San Francisco in 1985 was a highlight, where we shared with Skem and his Imperial College colleagues a dislike for an opera singer. NGI was most touched by John Hutchinson, a good friend since the late 50s, coming to Oslo to be with us when Ove Eide passed away in 1996. Such loyalty proves that, notwithstanding time and distance, personal relationship is what counts.

There have been a number of collaborative research projects between Imperial College and NGI, including the behaviour of clay, the testing of Drammen clay, laboratory techniques, measurement and significance of small strains, offshore tension piles, effect of sample disturbance, effect of stress path, and mutual cooperation in international reference groups and consulting projects. NGI has an alliance with GCG. The Geotechnical Consulting Group, in many ways, continues the culture and spirit of Alec Skempton and Imperial College.

Imperial College and especially NGI, now a private research and consulting foundation, operate very differently today compared to the 50s, 60s and early 70s. NGI is much more market-oriented than before and there is significantly less funding available to both Imperial College and NGI for research and international collaboration. In the increased globalisation worldwide and the research consortium model adopted by the EU, we hope that renewed collaboration can be achieved in the future.

It was only natural for NGI and the Bjerrum Memorial Fund to invite Skem to give the Bjerrum Memorial Lecture. Professor John Burland had given the Memorial Lecture in 1986. In the late 90s, it was seen as fitting to have Skem give the last of the Bjerrum Memorial Lectures (the memorial lectures in their original form were to last only until year 2000. After that the lecture was to change format.) As we started fearing for Skem's health, in 1997 we decided to ask him to give the Bjerrum Memorial Lecture in 1998. Skem said yes right away, although he did not like travelling any more. We were most happy. Skem suggested lecturing on Carsington Dam,

which sounded ideal to us. We prepared to receive him in Oslo. Unfortunately Skem was taken ill, and never felt that he could come to Oslo after that. Our loss.

Postlude

There is no doubt that Laurits Bjerrum was an expert at "human engineering", taking care of both science and people. He established the NGI culture which still prevails today. Yet, it is Skempton who said on the BBC in 1950:

"It is one thing to be an outstanding engineer or scientist, but to combine that with an understanding of the human values and to practice both together, is a combination everyone should aspire to."

Skem and Bjerrum, two great men of our profession, greatly influenced the birth and growth of two organisations internationally renowned for their geotechnical competence. Because of their personalities, they were bound to get along well. Each inspired the other, and the two organisations they led became important mainstays in the development of our profession.

Ralph B. Peck wrote in the introduction of Judith Niechcial's book on Skem: "Engineering is indeed a noble sport, and the legacy of good engineers is a better physical world for those who follow them." Using this as a measure of Skem and Bjerrum and the footprints they left in their organisations, we can only conclude that the two were among the greatest in our profession.

References

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