to feed on each test plant for 24 h. Glass chimneys with their top covered by muslin cloth were used to confine the insects to the test plants. After inoculation feeding, the insects were killed by spraying 0.05% Follidol and the plants were placed in an insect-proof chamber for observation. There were no symptoms of disease even after 20 days, suggesting both the species of aphids and white flies failed to transmit the disease.

The symptoms of the disease described resemble to some extent, those produced by the tobacco leaf curl virus on some of its hosts, and transmitted by white flies[1]. However, the virus causing disease in *J. curcas* L. is not transmitted by white flies. Moreover, chlorosis, which is so prominent in the case of the disease in *J. curcas*, is not common on plants attacked by tobacco leaf curl virus. The virus causing disease in *J. curcas* described by Garga[2] is not transmitted by sap. The virus causing disease in *J. curcas* in the present study is transmitted by sap, and thus differs from that reported earlier[2]. Transmission tests with the tobacco leaf curl virus vector, the white fly (*Bemessia tabaci* Gen)[3] also gave negative results.

The disease reported herein resembles the leaf curl and chlorosis in symptoms described earlier[3,4], but is not transmitted by white flies. The virus causing the disease in *J. curcas* should therefore be considered as a distinct record of a mosaic. Further studies on characterization are in progress.

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**NEWS**

MEETING REPORT

# Whither the alluvial fan research?*

Alluvial fans are depositional landforms whose surface forms a segment of a cone radiating downslope from a point where major drainages leave mountains. Knowledge of the fan-building process, its depositional facies, and stratigraphic build-up is important for exploration of economic deposits, groundwater prospecting, contaminant-dispersion problems, and in hazard prediction and mitigation plan for expanding human settlement on the fan surfaces in the mountainous regions.

In recent times, the definition of alluvial fan and its deposits has been the subject of a major controversy. It was proposed[1] that alluvial fans are distinctly different from and are virtually devoid of stream-channel deposits, and they form, small, coarse-grained sediment cones, having surface slope of 1.5° to ~25°, made up exclusively of debris flow or supercritical sheetflood deposits. Attempts were made to show[1] that geomorphology and sedimentology of braided streams (commonly believed to be a major component of alluvial fans) are different in being lens-shaped, cross-stratified gravel reflecting channelized lower flow regime condition. A natural slope gap between 0.5° and 1.5° was identified based on the observation that the slope of the studied fan surfaces exceeds 1.5° and the rivers commonly slope less than 0.5°. However, many of the earth scientists contradicted this view[2–4]. The debate prompted SEPM (Society for Sedimentary Geology, Tulsa, USA) to convene the first meeting on alluvial fans at Death Valley, California in 1995. As the debate on the definition of alluvial fans continued[5–7], and as newer experimental and field data continue to emerge[8,9], a second meeting[10] on alluvial fans was convened at Sorbas, Spain in 2003. Alluvial Fans 2007, convened at Canada was the third meeting of the series. Sixty participants from 21 countries discussed 38 oral and 18 poster presentations, spread over deliberations of three days and cushioned with two one-day field trips visiting some of the major alluvial fans of the Canadian Rockies. pre- and post-conference field trips were also organized to examine in more details some of these active fans.

Presentations in the meeting can be divided into four major categories: (1) Experimental studies and computer modelling of fans, fan deltas or related deposits. (2) Geomorphologic investigation of fans. (3) Study on the deposits and stratigraphic architecture of fans of Quaternary or older age, supported by high resolution chronology. (4) Hazard mitigation and management of fan-related environment. In an opening review of alluvial fan dynamics, Adrian Harvey (University of Liverpool) pointed out that the major controls of the fan sedimentation include geometry and lithology of the source basin, controls of the delivery system through climate and sediment supply, and basinal controls guided by base level. He illustrated the effect of these controls on fan sedimentation, with examples from Basin and Range Province of United States, Scotland and Oman. Harvey suggested that with better identification and quantification of different controls of fan development, it is possible to develop a genetic

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stratigraphic paradigm for these successions in the ancient rock record.

Improving on the series of recent laboratory simulations designed to throw light on alluvial fan debate[7,11], Maurits Van Djik *et al* (Utrecht) presented new experimental results on the development of fan and fan delta, and showed that both sheetflood and channelized flow alternately dominated the fan/fan delta-building processes. The experiments carried out under well-constrained boundary conditions convincingly demonstrated that periodic incision of fan/fan delta surfaces by channelized flow were in response to autogenic processes, without any change in exogenic controls (such as sediment supply, water discharge, base level or channel slope). They also showed that the initial deposition by sheetflood was followed by development of braided channels and channelization is more long-lasting and well-developed on alluvial fans than on fan deltas. Similar intrinsically-driven fan incision and channelization was reported by Clarke et al. (University of Exeter) in a differently designed experiment. D'Agostino and others (Italy) combined numerical simulation and laboratory experiments to quantify debris flow run-out distances that have important bearing on hazard mitigation in fan environments. In a flume study, Macdonald *et al.* (University of East Anglia, UK) reported generation of distinctive sedimentary structures formed under hydraulic jump. In a series of presentations on the alluvial fans of British Columbia (Jordon; Sakals *et al.*, Giles *et al.*) it was shown that many of the model parameters previously developed from the geomorphic studies of fans (e.g. Melton ruggedness ratio) may not satisfactorily predict the fan behaviour. Tom Millard *et al.* (Ministry of Forests, British Columbia) developed a unique method of comparing the behaviour of adjacent fans and thus the role of various controlling factors by studying fan channel network and grain size. It was pointed out repeatedly during the deliberations and during fieldwork that these densely vegetated fans of humid, temperate climate are different from those described in the literature mostly from the arid/semi-arid regions of interior US. Field trips before, after and during the conference provided opportunities to examine a variety of fans in Yukon and British Columbia that show the influence of glacial processes, vegetation, high discharge (combined effect of glacial melt water and winter storm precipitation) on the fan morphology and their depositional processes.

Study of the megafans, their origin, sedimentation pattern and relation to tectonic and climatic regime emerged out as an important research theme in the conference. These huge sediment lobes with their distributary drainage network in Andean foreland basin, Himalaya and China were discussed in several presentations. Comparison of Tista megafan imageries with the historical maps of the area shows that lobe switching rather than continuous channel shifting is typical of all these megafans, and in this way they are similar to the smaller debris flow-dominated alluvial fans of the arid to semi-arid climate, although the geometry and facies vary significantly (Chakraborty, India). Taquari megafan of Brazil, the largest of the modern megafans, was the focus of two presentations (Assine, Sao Paulo State University, and Makaske, the Netherlands) that explored the relative role of climate, tectonism, autogenic fluvial processes and anthropogenic activity in affecting the Taquari megafan.

Saito and Oguchi[9] showed that the alluvial fans of Japan could have surface slopes as low as 0.12°, finally disproving the 'natural slope gap' hypothesis[1]. On the other hand, sedimentological analysis of sub-Himalayan alluvial fan deposits was shown to be made up of both debris flow-sheetflood deposits as well as cross-stratified gravels formed under turbulent lower flow regime conditions (Rimpal Kar, India), supporting the results of laboratory experiments carried out independently. The tectono-geomorphic evolution of fan processes can be particularly well-constrained in the Quaternary fans as ultra high resolution dating facilities are now available. Tammy Rittenour (Utah State University) provided an excellent summary of basic principles, techniques and recent advancements in OSL, uranium series and cosmogenic radio nuclide dating techniques, emphasizing their importance in alluvial fan studies.

One of the remarkable features of the Banff meeting is that a large number of presentations recognized the importance of climatic factors that impacted fan sedimentation and attempted to separate out the climatic from tectonic signatures in the evolution of the alluvial fans. Fans formed in hyper-arid conditions of Chile (Mather *et al.*, University of Plymouth), those formed in the Mediterranean climate (Pope *et al.*, UK; Waters *et al.*, Durham University), and fans forming in humid climate (Yim *et al.*, Hong Kong) all showed climatic influence. It emerged from these studies that although tectonism played a major role in producing suitable geomorphology and the required accommodation space for the deposits, fan behaviour (progradation, retreat or incision), depositional processes (dominance of mass flow versus fluviatile facies) and cyclicity strongly relate to the climate oscillations. Ventra and others (Utrecht) reported studies of Miocene fans from Spain and with fine time resolution suggested a correlation of fan stratigraphy with Milankovich cyclicity.

Three-dimensional architecture of the modern fan deposits is poorly understood and the innovative study by Ulrich Beig *et al.* (Germany), combining ground penetrating radar survey with outcrop examinations of Death Valley and Swiss Alps fans, attempts to fill up this gap. In a comprehensive study of groundwater movement and non-point contaminant dispersion on the fluvial fans, Gary Weissmann *et al.* (University of New Mexico) combined elaborate computer modelling with aquifer testing drawdown data and geological models of fan-building. Among the large number of possible computer simulated groundwater flow patterns, geologic data allowed the authors to isolate a few solutions that reasonably match the observed dataset. Enhanced computing power and improved geological data on the subsurface facies distribution promise encouraging results for aquifer modelling and stratigraphic interpretations.

In the final summing up Gary Nicols (Royal Holloway, UK) emphasized that a spectrum of fan-shaped sediment bodies occurs in nature, varying in size from a few to hundreds of kilometres in radius, and composed exclusively of mass-flow gravels to dominantly channel-fill gravel–sand–mud mixture. Many case studies presented illustrate a near continuum of the processes, products and scales of these modern fans. However, in the absence of tools to reconstruct palaeogeomorphology, their recognition as fan deposits in ancient record is not always straightforward. One of the primary goals of future fan research would be to develop better facies models and stratigraphic architecture covering the entire spectrum of modern fans that would enable their confident identification in ancient record.


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# Quantitative genetics on the rise*

The science of genetics owes its origin to the rediscovery of Mendel's Laws of Inheritance in the year 1900. Earlier, the discovery of these laws was possible due to selection of discrete traits, each of which was apparently controlled by a single gene. Much before the rediscovery of Mendel's Laws, however, Francis Galton and Karl Pearson demonstrated that many traits in humans exhibited continuous heritable variation, which could not be explained by Mendel's Laws. Thus, soon after the rediscovery of Mendel's Laws, two main groups of geneticists emerged: the Mendelians, who believed that all heritable differences were qualitative and discontinuous, and the Biometricians, who proposed that all heritable variation was quantitative and continuous. Subsequently it was shown by Ronald Fisher and others that inheritance of quantitative variation could also be explained on the basis of Mendelian inheritance, if a trait is assumed to be controlled by many genes (polygenes) and further, if it is assumed that the expression of these polygenes is influenced by the environment. This also led to a distinction between simple and complex quantitative traits (QTs), and laid the foundation of quantitative genetics (QG).

Initially the inheritance of simple QTs (e.g. skin colour in humans, kernel colour in wheat or corolla length in *Nicotiana*) was studied using Mendelian methods. Later it was realized that most QTs are complex traits and their inheritance cannot be studied by Mendelian methods. Therefore, a biometrical approach was proposed that was popular during the 1960s and 70s. Though this approach allowed partitioning of genetic variances and estimation of genetic effects for individual QTs, it did not allow identification of individual loci contributing to the inheritance of a QT. The recent emergence of molecular markers and extensive use of statistics in the study of the inheritance of complex QTs allowed identification of the so-called quantitative trait loci (QTLs), which could be cloned and characterized to study the details of genetic control and biochemistry of QTs. The study of QTs could also be used in population genetics (PG) and evolutionary biology, which made this area of research most promising.

During the later half of the last century, QG had its ups and downs. For instance, at the First International Conference on Quantitative Genetics (ICQG1) held in Iowa State University, USA in 1976, there was a feeling of pessimism[1], which was largely overcome by the time the Second International Conference on Quantitative Genetics (ICQG2) was held in 1987 in North Carolina State University (NCSU), USA[2,3]. Since then, during the last two decades, significant progress in the field of QG has been made first, due to the availability of molecular markers and genome sequences, and secondly, due to the development of statistical tools for genetic dissection of quantitative traits. This was amply demonstrated in the presentations made at the Third International Conference on Quantitative Genetics (ICQG3) recently held in China.

The conference began on the first day (19 August) with registration, reception and a full-day workshop on 'Population genetics, QTL mapping and association mapping' for Chinese participants. Participation was truly international in nature with representatives from as many as 28 countries (including China) from all over the globe, signifying the interest of the international community in QG.

The academic programme started on the second day with opening remarks by William Hill (Edinburgh) and a special lecture by Bruce Walsh (Arizona), who outlined the progress made since ICQG2, and future prospects in the field of QG. This was followed by several invited lectures and selected contributed papers each day. In all, there were 11 sessions (including two poster sessions) comprising 23 invited lectures, 27 contributed oral presentations, and 72 posters (although all posters were not available for display). The presentations included papers that either involved discussions of general principles or methodology, or presentation of experimental results involving animal or plant systems. Use of both molecular markers and genomic sequences in the detection of QTLs was adequately covered; to some extent their use in population genetics and evolutionary biology

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