► Austin. The ALMA find is a hint that they formed at the same time as the planets.

But with the array not yet at full strength, many of the main conference results came from large, nearby objects — in particular, the giant clumps of gas within our Galaxy that become clusters of stars. Astronomers especially want to identify the elusive conditions that lead to the growth of high-mass stars — those 8–150 times heavier than the Sun. Such behemoths are rare, but are thought to have been the Universe's first stars and to have had a major effect on cosmic history. Their intense ultraviolet light would have ionized the hydrogen of interstellar space, for example, and they would have quickly exploded as supernovae, seeding the Universe with elements heavier than hydrogen and helium.

Yet astronomers have never witnessed a high-mass star being born, and hotly debate how they form. The turbulent-core theory posits that they originate in an exceptionally large knot of dense gas — a 'core' — in which turbulent winds

ALMA sees star-forming gas clumps in the 'brick'.

boost the internal pressure. That would allow the core to grow bigger than it ordinarily would before igniting by thermonuclear fusion and producing an outgoing 'stellar wind' of material that blows away the remaining gas and cuts

off growth. A rival theory, known as competitive accretion, suggests that the cores break up within the gas cloud, forming small protostars that later become giants by eating up material elsewhere in the cloud before their stellar winds can blow the gas away.

Advocates of both theories are looking to natural laboratories such as the brick for answers. Rathborne has identified some 50 possible cores within the cloud, which contains material with an overall mass of 100,000 Suns. But the images are not quite sharp enough to show whether the cores are large and bounded — as the turbulent-core theory suggests — or are seeds in the process of breaking up into smaller cores, which competitive accretion calls for. That detail could start coming in January with the next cycle of ALMA experiments, which will be conducted with at least 32 antennas. Whatever they show, Rathborne says, the region is a lode that astronomers will be mining for quite some time. Bricks like this, she says, "are made of gold". ■

JILL RATHBORNE/CSIRO/JCMT/ALMA

HIGHER EDUCATION

Russia shakes up its universities

Government plans to close struggling institutions and increase funding to the best.

BY QUIRIN SCHIERMEIER

The New Year is unlikely to be a happy one for thousands of Russian university teachers and students whose institutes are facing massive cuts and closures in 2013, following a controversial performance review. But some researchers are optimistic that despite the hardships, the most significant overhaul of Russia's university system in living memory will help to improve science and innovation in the country.

The move reflects the determination of Russian authorities to end support for hundreds of under-achieving institutions and to concentrate funding in a smaller number of high-performing universities. Since the collapse of the Soviet Union, demand for academic degrees has soared, and the number of public and private universities has doubled, to around 1,100. But Russia's science output has not increased accordingly, and higher-education experts and employers have long voiced concerns over the poor quality of many university programmes. Insiders suggest that no more than 50 Russian institutions are up to international standards.

After his election as president in March, Vladimir Putin decreed an overhaul of higher education while promising to increase university funding gradually over the next decade (see *Nature* 483, 253–254; 2012). To identify weak universities, the Ministry of Science and

Education commissioned an external audit of almost 600 public higher-education institutions. The results, leaked last month, made for depressing reading. Almost 500 of the institutions — 102 universities and 374 local branches — were found wanting, on the basis of criteria such as the quality of students, research intensity and productivity, and the amount of teaching space. About 40 of Russia's top universities, already classed as elite institutions by the government, were not included in the review.

Twenty institutions, including the Moscow State University for the Humanities (MSUH) and the Moscow State Evening Metallurgical Institute, were found to be so severely below par that the auditors recommended that they should be either closed or merged with more proficient institutions. Around 100 other universities are to be maintained but need to "optimize" their teaching and research performance, the auditors said. The ministry has already asked these institutions to submit development plans outlining how they intend to improve their performance, and a decision will be made about their future in April.

The audit has created a stir among Russian academics. Critics say that niche universities such as the MSUH — which the reviewers have labelled 'ineffective' — concentrate on teaching rather than

scientific research, so it was unfair to judge them on research performance. "One should have been more thoughtful in designing the criteria," says Isak Froumin, a senior education specialist with the Higher School of Economics (HSE) in Moscow, and former leader of the World Bank education programme in Russia.

But several analysts and researchers contacted by *Nature* agree that science and innovation are likely to benefit as the reforms free up money to strengthen programmes in the surviving universities. "Russia needs better-trained university graduates and it needs more and stronger university research," says Leonid Gokhberg, first vice-rector of the HSE and head of its Institute for Statistical Studies and Economics of Knowledge. "I think the proposed overhaul will be helpful in both respects."

An educational bill likely to come into effect early next year should cement the reforms: it aims to reduce the number of universities even further. Meanwhile, Putin has promised a marked increase in academic salaries, as well as bonuses for special achievements in teaching and research. The Russian government also plans to carry out an audit in 2013 of the academic performance of private universities.

"Despite its shortcomings, this was an overdue exercise," says Froumin. "The outcome may be painful for some universities but what counts more is that Russian students have a right to receive a decent education." ■

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