Solar System genealogy revealed by meteorites

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Infrared image of cold gas (blue) accumulated around a massive star(masked, at the centre of the image) which is a few million years old. Solar mass stars will form in this cold gas shell having a mass of 1000 solar masses, and located at roughly 10 pc (300 000 billion kilometres) from the central massive star. Our Sun was born in such a shell 4.5 billion years ago, together with some hundred of

twin stars. © Picture from Deharveng et al. (2010) Astronomy & Astrophysics 523, A6.

(Phys.org)—The stellar environment of our Solar System at its birth is poorly known, as it has accomplished some twenty revolutions around the Galactic centre since its formation 4.5 billion years ago. Matthieu Gounelle from the Laboratoire de Minéralogie et Cosmochimie du Muséum (Muséum national d'Histoire naturelle/CNRS) and Georges Meynet from the Observatoire de Genève established the Solar System genealogy in elucidating the origin of a radioactive element, ^{26}Al, which was present in the nascent Solar System. Their results are published this week in the journal *Astronomy & Astrophysics*.

Aluminium-26, a radioactive isotope of aluminium with a mean life of one million years was present in some meteoritic inclusions during the very first stages of the Solar System, 4.5 billion years ago. Its presence in the nascent Solar System had long been attributed to a supernova which would have exploded nearby the forming Solar System. However, the rarity of the association of a supernova and a forming star would imply that very special conditions lead to the Solar System formation.

From astronomical observations of young stars and astrophysical modelling, the two authors showed that the ^{26}Al originated instead from the wind of a massive star born a few million years before the Solar System. This star, not only synthesized the ^{26}Al found in meteoritic inclusions but also lead to the formation of the Solar System in accumulating gigantic quantities of hydrogen gas, from which a new star generation (including our Sun) formed. This massive star can therefore be considered as the parent star of our Solar System.

The authors show that the parent massive star, which they propose to call

Coatlicue (the Sun's mother in the Aztec cosmogony), and which is roughly 30 times more massive than our Sun, was born together with roughly 2000 stars. Coatlicue died since then in a supernova explosion. The Sun was born together with a few hundred twin stars whose chemical composition was identical to ours. These stars had a mass comparable to that of the Sun, but did not influence its development nor that of its planets. These twin stars are now dispersed in the Galaxy and cannot be identified. The proposed mechanism being a generic star formation process, it implies that the birth of our Solar System did not require special conditions as was believed until now. Numerous stars in the Galaxy were formed under similar conditions, suggesting that the Sun is a banal star.

More information: Matthieu Gounelle & Georges Meynet. The Solar System Genealogy revealed by Meteorites. *Astronomy & Astrophysics* 545, A4 (2012) - DOI: 10.1051/0004-6361/201219031

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