are less mobile than gold, providing a benchmark against which gold enrichment or depletion can be measured[5].

In a view that avoids the hypothesis of gold-enriched source rocks, it is the nature of large-scale hydrothermal leaching that is selective with respect to gold and any rock is an adequate source[6-8]. It is possible that gold-enriched rocks such as lamprophyres coexist with gold-mineralizing systems, but that the gold in the deposits is derived from an independent source, and the relationship between gold deposits and lamprophyres reflects a tectonic control.

The highest gold contents in Rock and Groves' data[1] come from variably deformed and hydrothermally altered calc-alkaline lamprophyres from the Canadian Arrow gold mine. Such occurrences of gold-enriched lamprophyres in gold mines are generally interpreted as the product of the late addition of gold, especially because, in most instances, the dykes are clearly not the locus of mineralization, but could have acted as dams or barriers to gold-bearing fluids[9]. There is additional evidence for their model in the elevated gold content of lamprophyres from south-west Scotland which, apparently, do not lie within the dispersion halos of large-scale gold deposits. The evidence is, however, open to at least one other interpretation. Whereas Rock and Groves attribute the low gold content of many calc-alkaline lamprophyres to either gold loss during crustal interaction or the non-uniformity of mantle source regions, it could be that apparently unaltered gold-rich dyke magmas have been contaminated during their ascent. Vein-type gold mineralization occurred in the same region as the Scottish dykes[1], and thus could have been a source of secondary gold enrichment in the lamprophyres.

Gold-bearing vein systems and lamprophyres generally developed along the same structural discontinuities, or fault systems, which guided their emplacement[1,2]. Therefore, both geological events are constrained to the same relatively small volumes, at least in the upper crust. The close spatial and temporal association of calc-alkaline (or shoshonitic) lamprophyres and mesothermal (deep) gold-mineralization occurs in several gold camps of various ages dating back to the Archaean[1,2,9,10]. Early prospectors in the Canadian Shield knew this 50 years ago, but the nature of the functional relationship remains unresolved. The current interest in lamprophyres stems from their specific temporal and tectonic setting, which may help elucidate contemporaneous tectonomagmatic processes at deeper crustal and mantle depths and, perhaps, the gold-mineralization system itself.

Rock fragments (xenoliths) entrained in rising magma provide evidence that the dykes have sampled a wide range of crustal material in these structural zones. In the contamination model, the high gold content in lamprophyres is largely accidental and gold abundance can vary markedly within a dyke swarm over comparatively short distances, or between lamprophyre dyke swarms in different gold provinces. Hence, the occurrence of barren lamprophyres near gold deposits of similar age can be attributed to the lack of intersection of individual dykes with gold-rich zones[2], or to the loss of primary gold from the lamprophyre magma at an earlier stage[1].

Significant lode-gold deposits of Archaean greenstone belts can be generated before, after and with regional metamorphism. On the other hand, geological mapping shows that lamprophyres are emplaced exclusively in the late-tectonic regime dominated by obliquely compressional tectonics that follow severe deformation and metamorphism[2]. If these observations stand up to examination, then either lamprophyres are a non-unique component of gold deposits, or lamprophyre magmas are generally present, but some factor in the tectonics of the premetamorphic deposits discriminates against their emplacement. Similarly, lamprophyres are not generally associated with the large recent (Au, Ag) vein deposits of Nevada, so that there could be an alternative mineralizing process (or several) or lamprophyres could be involved but remain unexposed.

Lamprophyres and (Au, Ag) vein deposits are characterized by abundant carbonate minerals, the stable-isotope composition of which could identify a genetic relationship between the two[10]. If calc-alkaline lamprophyres consist of crustally contaminated gold-bearing lamproites, as suggested by Rock and Groves[1], then further analyses should show that the lamproites have even higher average gold content. A marked and consistent difference in the volatile content and volatile composition of gold-rich and gold-poor calc-alkaline lamprophyres can also be predicted by Rock and Groves' model. □


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## Daedalus

# Arrest the offenders!

**ILLEGAL car-parking is a statistical game played between the car-owning public and the authorities. A potential illegal parker will risk quite heavy penalties if he perceives the chance of being caught as small enough. In several countries the authorities now impose a very severe punishment indeed: the wheel-clamp. The offending car is immovably shackled, and its hapless owner faces much trouble and expense before he can release it.**

**But even this deterrent is ineffective if the chance of being clamped is too small. So Daedalus now proposes a scheme to make it 100 per cent. It is based on those anaerobic glues which set solid in the absence of oxygen, and which are used by engineers to lock bolts into deep holes.**

**DREADCO's chemists are devising a thick, resilient, slightly tacky version of such a glue, for use as a road-surface. It does no harm to law-fully-moving traffic; indeed its slight tack enhances road-grip and inhibits skidding. But an illegally parked car cuts off the air from the glue beneath its tyres. The glue sets, and the returning owner finds his car glued to the spot. This elegant technology makes the crime not only match, but actually cause the punishment!**

**How will a glued car get free again? The DREADCO chemists hope to make their glue strong enough to strip the tread from the tyres when the owner, raging, finally drives away. He will have to drive home slowly and carefully, his pitted tyres advertising his disgrace, and will have to buy a whole new set. A special crew with blow-torches and scrapers may have to travel the roads removing the tread-sections left behind by glued vehicles, otherwise later cars with the same wheelbase might manage to park exactly on them, neatly evading the penalty. But Daedalus hopes to make his anaerobic glue reversible. Once a tread-section has been detached from a tyre, oxygen should slowly diffuse through the torn surface to release the section.**

**Many refinements of this cunning scheme are possible. Fifteen-, thirty-, and sixty-minute glues could be compounded, making possible an automatic and pitiless parking-meter system. Very fast-acting glues could be spread on those areas of road that you should not stop on even briefly. And areas of pavement vulnerable to street offences could also be treated. Hawkers, pamphleteers, prostitutes and market researchers would be forced to keep moving, or risk losing their shoes. The old English offence of 'loitering with intent' would be made very difficult; and offenders, glued to the spot, would be easy to arrest.** David Jones