Geoscience Canada

Carpe Diem - Shall We Make Earth Science First Among the Sciences in Canada?

GAC Presidential Address - Annual Meeting Vancouver, British Columbia 26 May 2003

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Volume 30, Number 3, September 2003

URI: https://id.erudit.org/iderudit/geocan30_3gac01

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Publisher(s)

The Geological Association of Canada

ISSN

0315-0941 (print)
1911-4850 (digital)

Explore this journal

Cite this article

Clague, J. J. (2003). Carpe Diem - Shall We Make Earth Science First Among the Sciences in Canada? GAC Presidential Address - Annual Meeting Vancouver, British Columbia 26 May 2003. *Geoscience Canada*, *30*(3), 85–90.

PRESIDENTIAL ADDRESS

Carpe Diem - Shall We Make Earth Science First Among the Sciences in Canada?

GAC Presidential Address
Annual Meeting
Vancouver, British Columbia
26 May 2003

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Earth science in Canada is at a crossroad. We can, through concerted action, establish our profession as fundamental and central among the natural sciences. If, on the other hand, we do not change our behaviour, which I believe is inward-looking and parochial, we will see slow and steady erosion in the stature of our profession.

In this address, I will point out the disturbing signs of the erosion in the stature of earth science. However, being an optimist, I will not dwell long on the negative; rather, I'll focus on ways of raising our profile and conveying to others the critical economic and societal importance of what we do.

DISTURBING SIGNS

First, the bad news: signs of what I believe is a slow decline in our profession. Our community has been strangely quiet on key societal issues to which we should be contributing. When we are involved, we do not speak with one voice, but rather argue with one another. A telling example is last year's firestorm over climate change and the Kyoto Protocol. The Kyoto debate was a flashpoint that highlighted the range of viewpoints among Canadian earth scientists over whether or not humans are affecting Earth climate. Some earth science societies and professional organizations issued contrasting position papers on the topic, whereas most, including GAC, concluded that taking a position was a "no-win" situation and, accordingly, sat on the sidelines. A debate over climate change is healthy, but unfortunately the quite different positions taken by various earth science groups both within and outside Canada served not only to justify the "business as usual" philosophy of government and the public, but also to send a signal to the public that earth scientists have nothing to contribute to this critically important societal issue. We, as a community, missed the opportunity to contribute to the climate-change debate when we failed to focus on what we can all agree to: climate change has always occurred and is natural. Earth scientists are unique among natural scientists in understanding deep time. We know that climate has changed continuously through time; we know with considerable certainty the global and regional scope and consequences of past climate change; and we, like no other group, can predict the impact of future climate change on life and Earth surface processes. However, rather than focus on an area of consensus within our community, we squabbled or were quiet.

We have also been silent in the debate over evolution. Zealous, well-organized religious fundamentalists are attacking the science of evolution and the very idea that the Earth is old. Their goal is to have the study of evolution banned from the classroom or, at the very least, taught on a par with creationist ideas. Let there be no mistake – this is a serious assault on the very foundation of earth science. The idea that the Earth was created about 6000 years ago on Sunday, October 23, 4004 BC, as proclaimed by Bishop James Ussher, is widely believed among the public. In my view, the earth science community has a fundamental responsibility to be proactive on this issue, to tell Canadians and their churches, as Gordon Winder says, "The Earth is old, the churches must be told." Some earth scientists are involved in the fray over this issue, but, collectively, we are silent.

More bad news is shown by the fact that university earth science researchers have failed in the NSERC Reallocation exercise. About ten years ago, the Natural Sciences and Research Council of Canada (NSERC) instituted a new procedure for allocating research monies to sciences and engineering in Canada. It created a new pot of money by taxing each of its committees, including Solid Earth and Environmental Sciences, 10% of that committee's normal monetary allocation. Each committee prepared a proposal to acquire a greater share of NSERC's reallocated monies. Unfortunately, in each of the three reallocation exercises to date, earth sciences has given up more money than it received back. Our performance, relative to many other sciences, has been dismal (Fig. 1). NSERC sent us a strong message after the last reallocation exercise, stating: "Despite the quality of the Canadian [earth science] community, the Reallocations Committee considered that the submission did not convey a sense of where the discipline is currently heading." This is strong medicine, my friends. A catastrophe has only been averted by recent overall increases in the federal government allocation to NSERC. Many geoscientists outside the

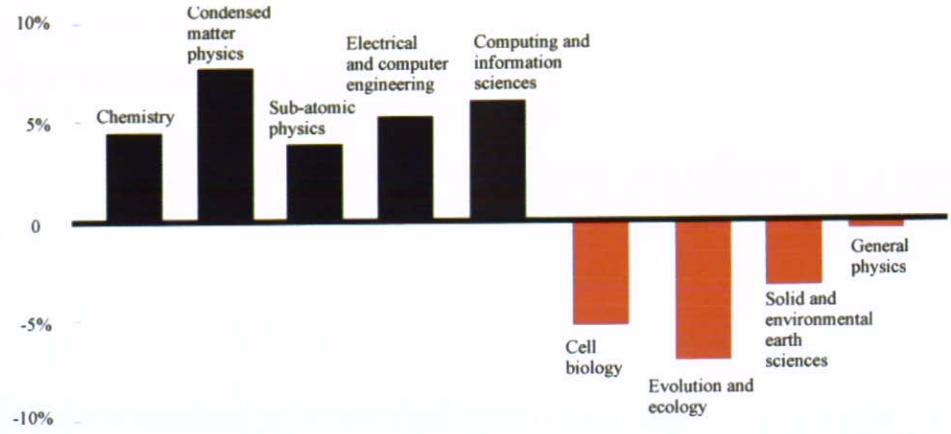

Figure 1 Performance of solid and environmental earth sciences, relative to some other disciplines, in the last NSERC Reallocation exercise. Earth science was one of the losers, suffering a reduction of 3.7% of its budget.

academic community may not view this as their problem, but I liken it to "the canary in the mine" – we cannot have a strong earth science profession in Canada without a healthy academic community. University research funds provide training for graduate students, the very future of our discipline. If we don't train the best of our youth, our profession will suffer.

Finally, it will come as no surprise that the mineral resource industry, which provides employment for many geologists and geophysicists, is not doing well. Investment in energy research in Canada has been declining for nearly two decades (Fig. 2), and the trend is unlikely to reverse in the immediate future. Investments in energy research translate into jobs. The continuing decline in these investments is stressing our profession and forcing us to readjust to the reality of fewer employment opportunities in mineral exploration.

THE GOOD NEWS

I'm convinced that this is earth science's century if we can meet the challenges that face us. Earth science is the only truly integrative science, and integrated science is required to address the social and economic problems facing us. It draws upon, and requires expertise in, biology, chemistry, physics, and mathematics. It also is the only natural science, aside from astronomy, founded in four dimensions. Much science is incomplete and ineffectual without a consideration of time. People, especially children, have a profound interest in many areas of earth science, such as dinosaurs, rocks, and minerals. Consider for a moment the primary school child who knows the Latin names of ten dinosaurs or spends his or her allowance on minerals. Geoscientists can tell real stories that no Hollywood movie producer can match – stories of drifting lithospheric plates, vast seas of glacier ice in North America and Europe, and extinct Ice Age elephants (Fig. 3). Finally, earth science is important to humanity. It has a key role to play in public health and safety – for example in issues as diverse as earthquakes, climate change, magnetic storms, groundwater contamination, and radon exposure.

As an example, I return to the issue of climate change. Earth scientists must explain to the public how climate has changed in the past. We should tell them about the causes of climate change, including orbital forcing, atmosphere-ocean feedbacks, volcanism, and variations in solar radiance. And we must describe how past changes in climate, on timescales from thousands of years to decades, have affected vegetation, animals, and the landscape. By doing so, we give people a sense of how the world may change, and how they may have to adapt, if climate changes in the way predicted by most atmospheric scientists. Low-lying coastal areas, for example, may be flooded by rising seas, and melting permafrost may create problems for Canadians living in the Arctic.

Earth science is also the crucial science for providing the resources that we require to live and from which wealth is generated. Imagine a world without products made from oil and metals, which geologists and geophysicists find (Fig. 4). Look around you – everything you see comes from the Earth. We should not be shy about telling people that Earth resources are crucial for their well-being and that earth scientists help provide these resources.

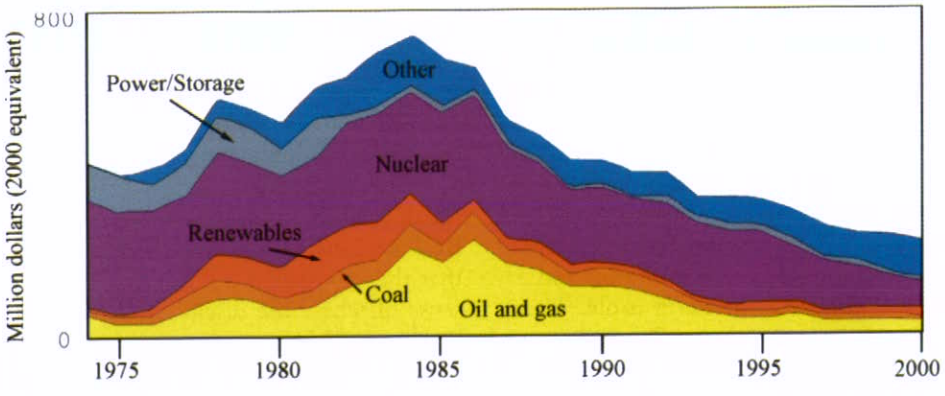

Figure 2 Funding of energy research and development in the energy sector in Canada (Hall and Lawton, 2003; data courtesy of R. Mansell, University of Calgary).

THE CHALLENGE WE FACE

With so much working in our favour, why is the public unaware that what we do is useful and important? The answer, in my view, lies in the diversity that characterizes our discipline. Diversity is perhaps our greatest strength, but it is also our Achilles heel. Earth science in Canada, as in most other developed

Figure 3 Earth scientists have fascinating stories that captivate the public.

Figure 4 Minerals and petroleum are required for most of what we use at work, in the home, and at play. Reproduction of a poster entitled "Minerals at Work Home and Play," courtesy of Saskatchewan Industry and Resources (formerly Saskatchewan Energy and Mines).

countries, is badly fragmented, almost dysfunctional. Earth science encompasses a wide variety of communities, or tribes, who think they have little in common – geophysicists, geochemists, geomorphologists, physical geographers, engineering geologists, hydrologists, groundwater geologists, and so on. These tribes rarely interact with one another and speak different languages, replete with jargon that stifles inter-tribal communication. We have a multitude of earth science societies and organizations in this country, each serving the particular interests of its members, for example AQQUA, CANQUA, CGRG, CGU, CSEG, CSPG, GAC, MAC, SEG, APEGA, APEGBC, APEGM, and APEBS. Tribes of like-minded professionals, of course, are a good thing. Just as British Columbians or Quebecers should consider themselves, first and foremost, Canadians, petroleum geologists, geomorphologists, and glaciologists should take pride in being earth scientists. Only then will we be able to reduce the fragmentation and divisiveness that plague our profession.

Our challenge, in my view, is to come together as a single community of earth scientists working towards common goals while maintaining our disciplinary diversity. We must rise above our parochialism and collectively and aggressively promote the value of earth science in Canada. Further, we must integrate earth science into the other natural sciences.

How can we achieve these goals? First, we must support national earth science organizations, such as the Canadian Geoscience Council (CGC), Canadian Geoscience Education Network (CGEN), and Geological Survey of Canada (GSC). CGC can serve as an advocate for all earth scientists in Canada. It has failed to do this, not because of a lack of hard work on the part of its directors, but rather because a lack of commitment from its member societies. CGEN could conduct a coordinated campaign of public earth science education, but it, too, is grossly under-supported. The GSC is currently reinventing itself and deserves the vigorous support of every geoscientist in Canada.

A WAY FORWARD

What are the issues that earth scientists should collectively champion? They are issues that are important, not just to earth scientists, but to the larger public: public safety, health, and resources. In the areas of public safety and health, we need to focus on water quality, natural hazards, metals in the environment, magnetic storms, acidification of lakes, radon, and impacts of climate change. In the area of resources, we must loudly proclaim what may seem obvious to us – 1) Earth resources are finite; 2) discovering new resources is essential, not a luxury; and 3) modern geoscience will allow us to continue to do what we have always done well, *i.e.* find hydrocarbons, metals, industrial minerals, and groundwater.

A key element in a plan to make earth science first among the sciences in Canada should be a coordinated, nation-wide program of public geoscience education. Above all, we must teach primary and secondary school students about the Earth and its processes. We must not shrink from controversial issues such as the age of the Earth, evolution, and climate change. Effective education is generally a local, grassroots activity, thus one of our best strategies as a community might be to fully and enthusiastically support the small corps of dedicated individuals who bring earth science to the community.

I'll close with several examples of educational success stories that have happened with only limited support from our community. Think how much more could be achieved if these and other efforts were more fully embraced and supported.

EdGEO (http://www.edgeo.org), initiated in the early 1970s, supports local earth science workshops for Canadian teachers (Fig. 5). The primary objective of EdGEO is to provide educational opportunities for teachers and, through them, their students. EdGEO workshops increase teachers' knowledge and confidence, and equip them with new classroom resources.

EarthNet (http://agc.bio.ns.ca/EarthNet) is a unique website tailored to the needs of Canadian earth science educators. These needs centre on easy access to basic earth science information. Teachers want information that is reliable, low cost, interesting, based on the Pan Canadian curriculum, and centrally located for "one-stop shopping".

The Geoscape Canada program (http://geoscape.nrcan.gc.ca/), led by the Geological Survey of Canada, in partnership with provincial and municipal agencies and educators, communicates practical earth science information to communities across Canada. The program operates on the premise that if we want to show Canadians the usefulness of geoscience information, we must explain local earth science issues that are relevant to them. The Geoscape Canada program builds on the success of *Geoscape Vancouver*, a graphic-rich, full-colour poster that focuses on important geoscience issues in the Vancouver area, for example earthquakes, landslides, surface water, and groundwater (Turner et al., 1996; Clague et al., 1998). Geoscape posters and websites are, or soon will be, available for Victoria, Nanaimo, the Fraser River basin in British Columbia, Whitehorse, Calgary, southern Saskatchewan, Toronto, Ottawa, the Grand River basin in southern Ontario, Québec, Montréal, and Nunavut.

New earth science books targeted at the public and students are being produced with increasing frequency. Recent examples include the *The Last Billion Years*, a beautiful book on the geology and geological evolution of the Maritimes; *Vancouver, City on the Edge*; and *Geology of the Kelowna Area* (Fig. 6).

CGEN hosted the Fourth International IGEO (International Geoscience Education Organisation) Conference in August 2003. It provided a forum for educators to share teaching ideas and experiences that advance earth science education at the local, national, and international levels. The conference was a showcase for Canadian earth science education, and its success is a testament to the will of our small group of inspired geoscience 'evangelists.'

In my opinion, the way forward has three basic aspects. We must first defragment our profession. Defragmentation is possible if we make a serious commitment, through our regional and discipline-based organizations, to a national group that gives us a public profile and that advances the causes outlined in this article – something along the lines of the American Geological Institute in the

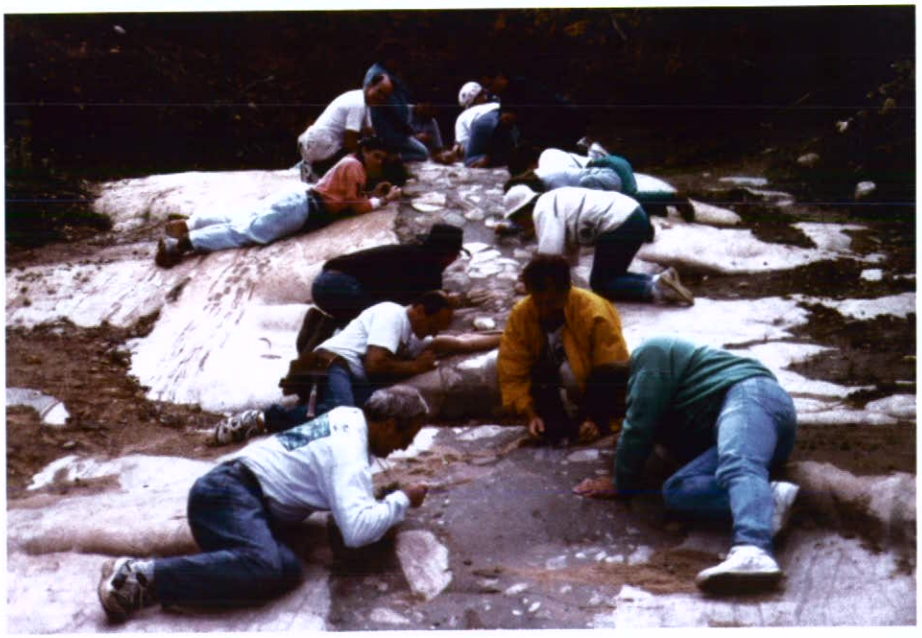

Figure 5 EdGEO fieldtrips provide teachers with a close-up look at local geology and instill in them an excitement and interest to share with their students (Papineau-Labelle Wildlife Reserve, Québec).

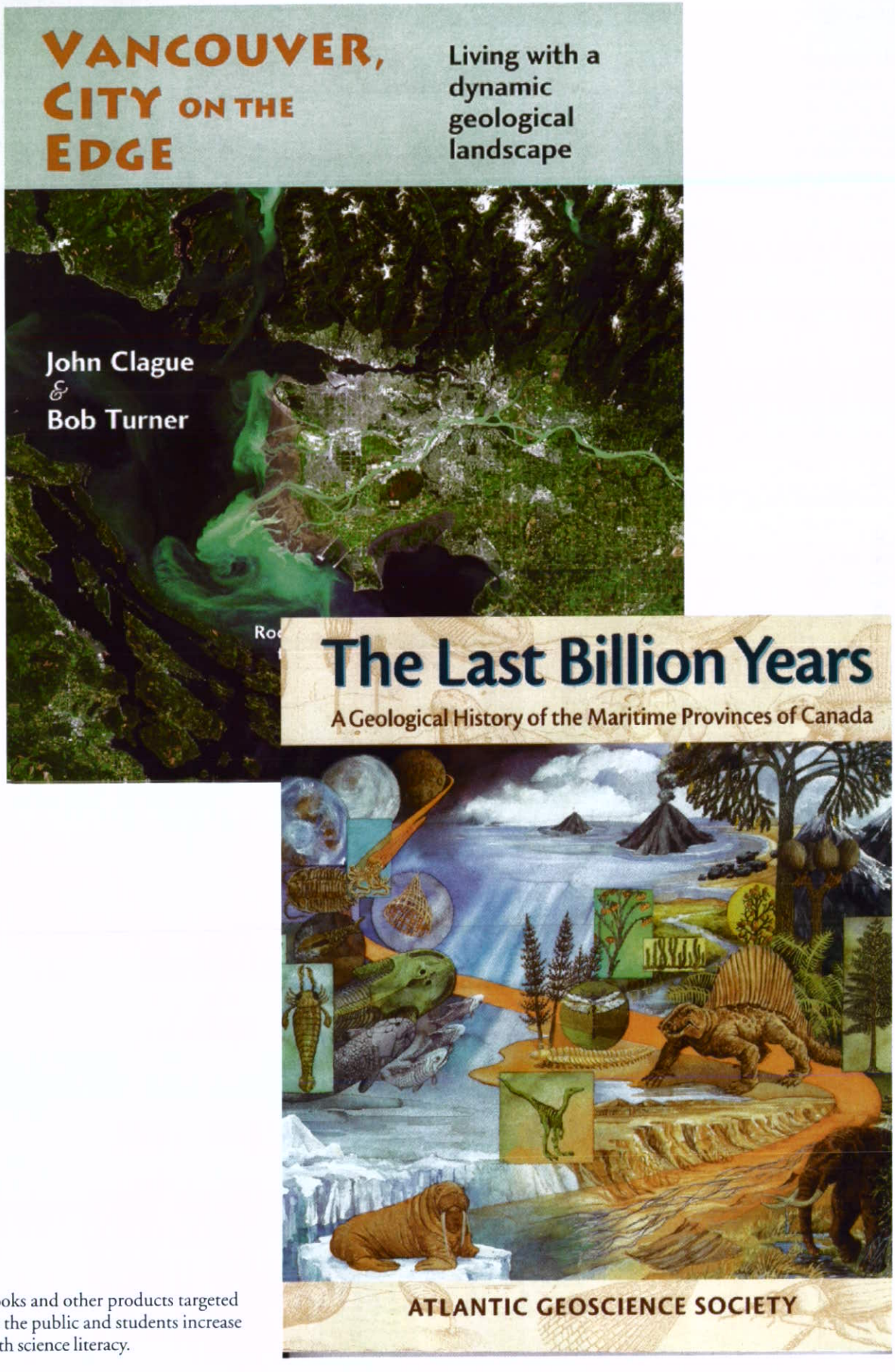

Figure 6 Books and other products targeted specifically at the public and students increase Canadian earth science literacy.

U.S.; perhaps a reborn CGC. I am not so naïve as to believe this is easily achievable. It will only happen if we collectively want it to happen, and this is far from a given. Second, we must lobby, through this body and perhaps others, to have earth science included in secondary school curricula across the country. Third, we must provide tangible support to those individuals who are the interface between earth scientists and the public. The attitude that outreach is a secondary activity of less importance than science is 'harmful to our health.'

My question to you is "Will we rise to the challenge that clearly faces us?" Of course we can, the twenty-first century is ours for the taking!

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